NOVEMBER, 1924

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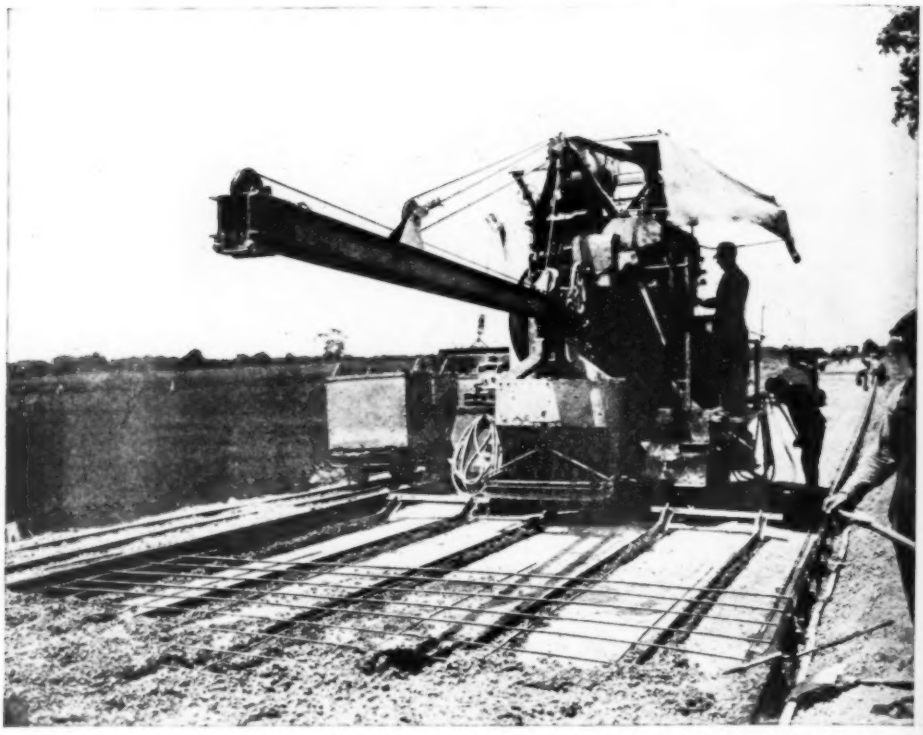
Contractors' and Engineers' Monthly



Construction of reinforced concrete road, East Orwell, Ashtabula County, Ohio. Truscon Rib Bars and Placing Sled used throughout entire road.

The Flat Sheets are Quickly Placed

Truscon Wire Mesh is a labor saver for the road builder because this electrically welded mesh can be furnished in flat sheets in the weight and size desired ready for immediate use—all unrolling and cutting of mesh are eliminated.

***Truscon Rib Bar** when laid with installing device assures accurate, even placement of the mesh and ease and economy in handling.*

Truscon Wire Mesh and Contraction Joints prolong the life of the pavement at least one-fifth over the plain concrete road. Tests have proven that the reinforced pavement is by far the most economical in maintenance and most generally satisfactory in all respects.

The book "Modern Road Construction" gives invaluable information to road builders. If you are interested in road construction write us on your letterhead for a copy.

TRUSCON STEEL COMPANY, Youngstown, Ohio

Warehouses and Sales Offices from Pacific to Atlantic. For addresses see phone books of principal cities. Canada: Walkerville, Ont. Foreign Div.: New York.

TRUSCON
WIRE MESH AND CONTRACTION JOINTS

VOL. IX. NO. 5 CONTRACTORS & ENGINEERS' MONTHLY NOVEMBER, 1924
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Where to Purchase

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment.

The Index to Advertisers faces the inside back cover. When writing to advertisers please mention the CONTRACTORS' & ENGINEERS' MONTHLY. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

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** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

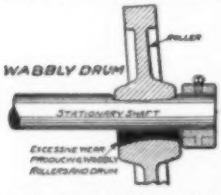
KOEHRING

Consider Bearings First

WORN bearings mean vibration — crystallization — disalignments, strains and breakages in *every part of the whole machine.*

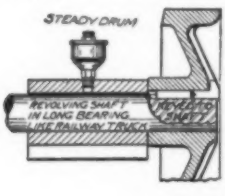
The service life of any machine is first of all in the bearings—especially in the drum rollers of a mixer which get continuous service under heavy, shifting loads. Bearings must be right in principle or they can not be right in practice.

The Koehring drum roller bearing is the type accepted by engineers as best for heavy duty service—the same as used on freight car trucks. And Koehring heavy duty construction makes them liberally — generously — oversize — one of the fundamental reasons for Koehring long service life and remarkable freedom from breakdowns and delays.

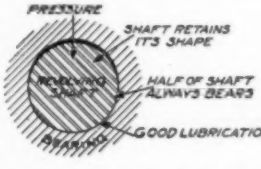


CUT at left shows a "line" type of bearing—the revolving unit always turning on a fixed or stationary axle. The cut at the right shows the characteristic wear that results when this type is applied to drum rollers. The down-thrust of the heavy drum brings all the wear on the top side of the fixed axle, flattening it. The end-to-end thrust of materials, tumbling inside the drum, wears the outside edges of the roller openings. Even a slight amount of wear allows rollers to wabble, causing disalignment, pounding, vibration and strain throughout the mixer—the principal causes of breakage everywhere.

The right hand cut also shows clearly how this wear on the line bearings *prevents* lubrication. Enlargement of the roller opening soon leaves a considerable space between the lower side of the fixed shaft and the roller. Lubrication is squeezed down and pocketed. The heavy thrust on the top side of the shaft prevents adequate lubrication staying between the fixed axle and revolving roller.



THIS is the Koehring type—the roller *fixed to the shaft and the shaft turning in oversize, adjustable shimmed bearings accessible on main frame.*



At the right is shown how the Koehring revolving shaft always carries the load on the full face of the fully lubricated bearings.

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Pavers—7, 10, 14, 21 and 34 cubic feet of mixed concrete.
Construction Mixers—10, 14, 21 and 28 cubic feet mixed concrete.
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A2306—III—IV

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Telfax Tape Marked

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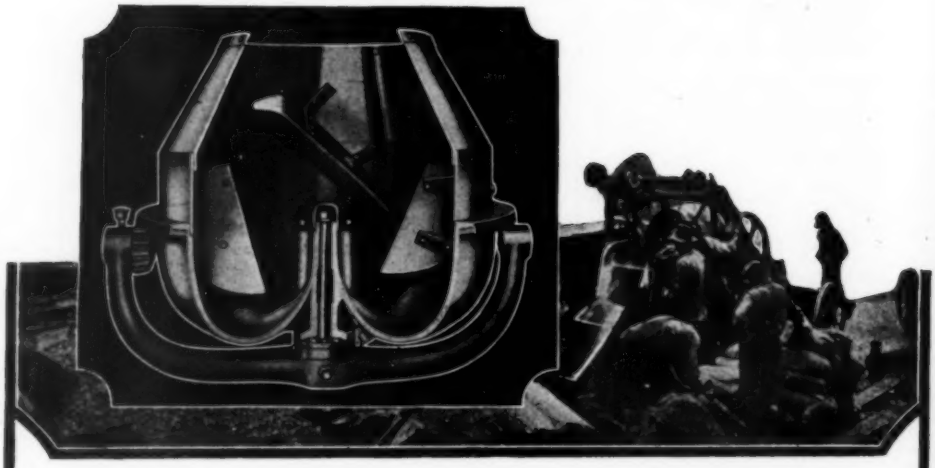
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Foundry Mfg. Co., St. Albans, Vt.
Gilbert Mfg. Co., Aberdeen, S. Dak.
Klauer Mfg. Co., Dubuque, Iowa.
Madison Foundry Co., Cleveland, O.
Pechstein Iron Works, Keokuk, Ia.



When In Doubt Buy a WONDER

TWELVE years ago the Construction Machinery Company originated the SINGLE-BEARING WONDER MIXERS. Unhampered by precedent or possibility of infringement, we adopted the design of Bearing pictured above—the stationary shaft support and the dust proof Ball Bearing Race to absorb the only wear there should be in a Mixer of this type.

Since then from time to time, other Manufacturers attracted by the popularity of the WONDER, have adopted the type but none have approached the perfection of the WONDER Bearing.

After twelve years of observation and knowledge gained from our thousands of users, it is now possible for the Construction Machinery Company to eliminate all confusion in the mind of the buyer concerning the correct design for the Bearing of a Single Opening Mixer. Without a change in its design during that period the WONDER Bowl Bearing now unqualifiedly carries the following guarantee to the purchaser:

NOTICE

It is an infringement to make, use or sell a patented invention without authority under the patent. Our patents have been sustained by the United States Courts in six different instances. Purchasers of our Mixers are protected.

GUARANTEE

We agree to furnish gratis any part of a WONDER MIXER drum bearing, if needed, during the life of a WONDER MIXER.

HERE IS LOW MIXER UP-KEEP GUARANTEED

CONSTRUCTION MACHINERY COMPANY

Formerly Waterloo Cement Machinery Corporation

447 Vinton Street **WATERLOO, IOWA**

Portable Machinery Co., Passaic, N. J.
Sessions Foundry Co., Bristol, Conn.
South Bend Foundry Co., South Bend, Ind.

CATCH BASINS (See Castings, Street and Sewer)

CATCH BASIN CLEANING APPARATUS
*International Motor Co., New York.
Elgin Sales Corp., New York.

CAULKING MACHINERY AND TOOLS
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Mueller Company, Decatur, Ill.

CEILINGS, METAL
Berger Mfg. Co., Canton, O.
Canton Art Metal Co., Canton, O.
Globe Iron Roofing & Cor. Co., Cincinnati, O.
Newport Rolling Mill Co., Newport, Ky.
Klauer Mfg. Co., Dubuque, Iowa.
Mesker & Co., Geo. L., Evansville, Ind.
Milwaukee Corrugating Co., Milwaukee, Wis.
Wheeling Corrugating Co., Wheeling, W. Va.

CEMENT
*Pennsylvania Cement Co., New York.
Ætna Portland Cement Co., Detroit, Mich.
Allentown Portland Cement Co., Allentown, Pa.
Alpha Portland Cement Co., Easton, Pa.
Ash Grove Lime and Portland Cement Co., Kansas City, Mo.
Atlas Portland Cement Co., New York.
Atlas Portland Cement Co. (of Kansas), Independence, Kans.
Bath Portland Cement Co., Philadelphia, Pa.
Beaver Portland Cement Co., Portland, Ore.
Bessemer Limestone and Cement Co., Youngstown, O.
Bonner Portland Cement Co., Kansas City, Mo.
Canada Cement Co., Ltd., Montreal, Canada.
Castalia Portland Cement Co., Pittsburgh, Pa.
Clinchfield Portland Cement Corp., Kingsport, Tenn.
Colorado Portland Cement Co., Denver, Colo.
Continental Portland Cement Co., St. Louis, Mo.
Coplay Cement Manufacturing Co., Coplay, Pa.
Cowell Portland Cement Co., San Francisco, Cal.
Crescent Portland Cement Co., Wampum, Pa.
Dewey Portland Cement Co., Kansas City, Mo.
Dexter Portland Cement Co., Nazareth, Pa.
Diamond Portland Cement Co., Cleveland, Ohio.
Dixie Portland Cement Co., Chattanooga, Tenn.
Edison Portland Cement Co., New York.
Fredonia Portland Cement Co., Fredonia, Kans.
Giant Portland Cement Co., Philadelphia, Pa.
Gilmore Portland Cement Corp., Gilmore City, Iowa.
Glens Falls Portland Cement Co., Glens Falls, N. Y.
Golden State Portland Cement Co., Los Angeles, Cal.
Great West'n Port. Cem. Co., Kansas City, Mo.
Gulf States Portland Cement Co., Demopolis, Ala.
Hawkeye Portland Cement Co., Des Moines, Ia.
Helderberg Cement Co., Albany, N. Y.
Hercules Cement Corp., Philadelphia, Pa.
Indiana Portland Cement Co., Indianapolis, Ind.
International Portland Cement Co., Ltd., Spokane, Wash.
Kansas Portland Cement Co., Kansas City, Mo.
Knickerbocker Portland Cement Co., Inc., New York.
Kosmos Portland Cement Co., Louisville, Ky.
Lawrence Portl'd Cement Co., Northampton, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Louisville Cement Co., Louisville, Ky.
Marquette Cement Mfg. Co., Chicago, Ill.
Missouri Portland Cement Co., St. Louis, Mo.
Monarch Cement Co., Humboldt, Kans.
Monolith Portland Cement Co., Los Angeles, Cal.
National Cement Co., Birmingham, Ala.
Nazareth Cement Co., Nazareth, Pa.
Nebraska Cement Co., Denver, Colo.
Newago Portland Cement Co., Newago, Mich.
New Egyyptian Portland Cement Co., Fenton, Mich.
New York & New England Cement & Lime Co., New York.
Northwestern States Portland Cement Co., Mason City, Ia.
Ogden Portland Cement Co., Ogden, Utah.
Oklahoma Portland Cement Co., Denver, Colo.
Old Mission Portland Cement Co., San Francisco, Cal.
Olympic Portl'd Cement Co., Ltd., Seattle, Wash.
Oregon Portland Cement Co., Portland, Ore.
Pacific Portland Cement Co., San Francisco, Cal.
Peerless Portland Cement Co., Union City, Mich.
Peninsular Portland Cement Co., Cement City, Mich.
Penn-Allen Cement Co., Allentown, Pa.
Petoskey Portland Cement Co., Petoskey, Mich.
Phoenix Portland Cement Co., Nazareth, Pa.
Portland Cement Co. of Utah, Salt Lake City, Utah.
Pyramid Portland Cement Co., Des Moines, Ia.
Riverside Portl'd Cement Co., Los Angeles, Cal.
San Antonio Portland Cement Co., San Antonio, Tex.
Sandusky Cement Co., Cleveland, Ohio.
Santa Cruz Portland Cement Co., San Francisco, Cal.
Security Cement and Lime Co., Hagerstown, Md.
Signal Mountain Portland Cement Co., Chattanooga, Tenn.
Southern States Portland Cement Co., Rockport, Ga.
Southwest'n Portland Cement Co., El Paso, Tex.
Standard Portland Cement Corp., San Francisco, Calif.
Sun Portland Cement Co., Portland, Ore.
Superior Portland Cement Co., Seattle, Wash.
Texas Portland Cement Co., Dallas, Tex.
Three Forks Portland Cement Co., Denver, Colo.
Tidewater Portland Cement Co., Baltimore, Md.
Trinity Portland Cement Co., Dallas, Tex.
Union Portland Cement Co., Ogden, Utah.
United States Potash Co., Los Angeles, Cal.
U. S. Portland Cement Co., Denver, Colo.
Universal Portland Cement Co., Chicago, Ill.
Vulcanite Portland Cement Co., Philadelphia, Pa
Wabash Portland Cement Co., Detroit, Mich.
Wellston Iron Furnace Co., Jackson, Ohio.
Whitehall Cement Mfg. Co., Philadelphia, Pa.
Wolverine Portl'd Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Detroit, Mich.

CEMENT GUNS
Cement Gun Co., Allentown, Pa.

CEMENT INSPECTION (See Inspecting Laboratories)

CEMENT TOOLS
*Abrams Cement Tool Co., Detroit, Mich.

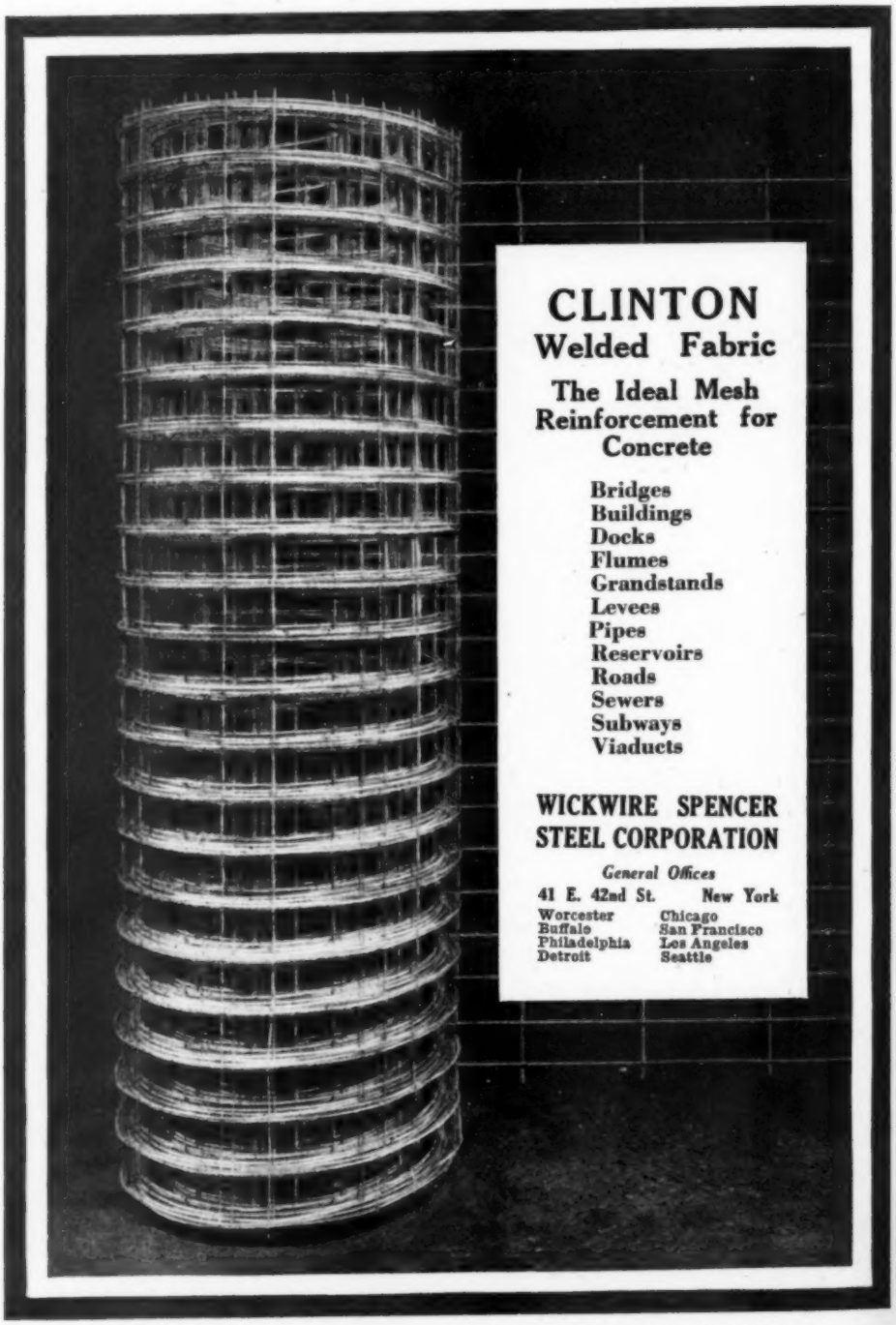
CENTRIFUGAL PUMPS
(See "Pumps, Centrifugal")

CHAINS
American Chain Co., Inc., Bridgeport, Conn.
Chain Belt Co., Milwaukee, Wis.
Columbus McKinnon Chain Co., Columbus, O.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Niagara Metal Stamp Corp., Niagara Falls, N. Y.
U. S. Chain & Forge Co., Pittsburgh, Pa.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CHEMICALS FOR WATER PURIFICATION
Arnold, Hoffman & Co., Inc., New York.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Electro Bleaching Gas Co., New York.
General Chemical Co., New York.
Hooker Electrochemical Co., New York.
Mathieson Alkali Works, Inc., New York.
Penna. Salt Mfg. Co., Philadelphia, Pa.

CHIMNEYS, CONCRETE
Heine Chimney Co., Chicago, Ill.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

CHIMNEYS, RADIAL BRICK
American Chimney Corp., New York.
Alphons Custodis Chimney Const. Co., New York.
Heine Chimney Co., Chicago, Ill.
Heinicke, Inc., H. R., Indianapolis, Ind.


CLINTON
Welded Fabric
The Ideal Mesh Reinforcement for Concrete
Bridges
Buildings
Docks
Flumes
Grandstands
Levees
Pipes
Reservoirs
Roads
Sewers
Subways
Viaducts
WICKWIRE SPENCER STEEL CORPORATION
General Offices
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Worcester
Buffalo
Philadelphia
Detroit
Chicago
San Francisco
Los Angeles
Seattle

Kellogg & Co., M. W., New York.
Rust Engineering Co., Pittsburgh, Pa.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS
*Wallace & Tiernan Co., Inc., Newark, N. J.

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE
*Insley Mfg. Co., Indianapolis, Ind.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Lakewood Engineering Co., Cleveland, O.

CLIPS, WIRE ROPE
American Hoist & Derrick Co., St. Paul, Minn.
Marion Malleable Iron Works, Marion, Ind.
Mockbee & Co., C. M., Cincinnati, O.
Roebling Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.

COAL AND ORE CONVEYING MACHINERY
*Good Roads Mach'y Co., Kennett Square, Pa.
*L. P. Green, Chicago, Ill.
*Haiss Mfg. Co., Geo., New York.
Barber-Greene Co., Aurora, Ill.
Bartlett & Snow Co., C. O. Cleveland, Ohio.
Brown Hoisting Mchy. Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kon-Wald Co., Buffalo, N. Y.
Lidgerwood Mfg. Co., New York.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Robins Conv. Belt Co., New York
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

COCKS, CURB AND CORPORATION
*Union Water Meter Co., Worcester, Mass.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Glauber Brass Mfg. Co., Cleveland, Ohio.
Haydenville Co., Haydenville, Mass.
Mueller Company, Decatur, Ill.

COLUMN CLAMPS
*Insley Mfg. Co., Indianapolis, Ind.
Phillips, Co., Victor L., Kansas City, Mo.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Symons Clamp Co., Chicago, Ill.
Universal Form Clamp Co., Chicago, Ill.

COMPRESSORS, AIR (See Air Compressors)

CONCRETE FLOOR HARDENER
Anti-Hydro Waterproofing Co., Newark, N. J.
General Chemical Co., New York.
General Fireproofing Co., Youngstown, Ohio.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders Co., Cleveland, O.
Sonneborn Sons, Inc., L., N. Y. "Lapidolith"
Truscon Laboratories, Detroit, Mich.

CONCRETE MIXERS
*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Atlas Eng. Co., Milwaukee, Wis.
*Construction Mchy. Co., Waterloo, Iowa
*Jaeger Machine Co., Columbus, O.
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Austin Machinery Corp'n, Muskegon, Mich.
Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Contractors' Equipment Co., Keokuk, Ia.
Foote Concrete Mchy. Co., Chicago, Ill.
Gray Iron Fdry Co., Reading, Pa.
Judy Mfg. Co., Centerville, Ia.
Knickerbocker Co., Jackson, Mich.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Leach Co., Oshkosh, Wis.
Marsh-Capron Co., Chicago, Ill.
Milwaukee Concrete Mixer Co., Milwaukee, Wis.
Republic Iron Works, Tecumseh, Mich.
Schramm, Inc., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
Standard Scale & Supply Co., Pittsburgh, Pa.
Truckmixer Co., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

CONCRETE PILING. (See Piling, Concrete)

CONCRETE REINFORCEMENT
*Truscon Steel Co., Youngstown O.
*Wickwire Spencer Steel Corp., New York.
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Concrete Steel Co., New York.
Consolidated Expanded Metal Co., Braddock, Pa.
Electric Welding Co., Pittsburgh, Pa.
General Fireproofing Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
Kalman Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
National Steel Fabric Co., Pittsburgh, Pa.
Ryerson & Son, J. T., Chicago, Ill.
Youngstown Pressed Steel Co., Warren, O.
Youngstown Sheet & Tube Co., Youngstown, O.

CONCRETE ROAD FINISHERS
Dunn Road Mach. Co., Conneaut, Ohio.
French & Co., A. W., Chicago, Ill.
Heltzel Steel Form & Iron Co., Warren, O.
Lakewood Eng. Co., Cleveland, Ohio.

CONCRETE SURFACING MACHINES
*Concrete Surfacing Machy. Corp., Cincinnati, O.

CONCRETE TOOLS
*Dallett Co., The, Philadelphia, Pa.

CONDENSERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dean Bros. Co., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mach'y Corp., New York

CONDUIT RODS
Bissell Co., F., Toledo, Ohio.
Turbine Sewer Machine Co., Milwaukee, Wis.
Waldo Bros. & Bond Co., Boston, Mass.

CONDUITS, INTERIOR
American Circular Loom Co., New York.
Central Tube Co., Pittsburgh, Pa.
Clifton Mfg. Co., Boston, Mass.
Garland Mfg. Co., Pittsburgh, Pa.
National Metal Molding Co., Pittsburgh, Pa.
Sprague Electric Wks., New York.
Youngstown Sheet & Tube Co., Youngstown, O.

CONDUITS, UNDERGROUND
American Vitrified Products Co., Akron, Ohio.
Fibre Conduit Co., Orangeburg, N. Y.
Johns-Manville, Inc., New York.
National Fireproofing Co., New York.

CONTRACTORS' SUPPLY DEALERS
(See pages 103-119)

CONVEYORS, BELT
*Austin-Western Rd. Mach'y Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Barber-Greene Co., Aurora, Ill.
Chain Belt Co., Milwaukee, Wis.
Gifford Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Portable Machinery Co., Passaic, N. J.
Robins Conv. Belt Co., New York.
Standard Conveyor Co., No. St. Paul, Minn.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CONVEYORS, BUCKET
*Atlas Engineering Co., Milwaukee, Wis.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Bartlett & Snow Co., C. O., Cleveland, O.
Caldwell & Son, H. W., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford Wood Co., Hudson, N. Y.

United
Constructor

"See it at the Show"

Part of a fleet of ten United "Constructors" owned by McCoun Construction Co., Noblesville, Ind.

THE United "Constructor" is first and last a road constructor's truck, designed and built for one type of service and sold exclusively to contractors by reliable distributors of contractors' equipment.

Its ability in its field has been proven by the hardest kind of test, the test of actual use. United engineers have created this unit to meet the exacting requirements that this service demands and the records it has made for dependability and economy have shown that it is designed right and built right.

* One contractor writes, "No more experimenting, Uniteds have met the demand."

* Another writes, "Ten Uniteds have totaled 140,000 miles this season. We have never broken a spring, although the sub-grade has been rough and an average of 30 miles per hour maintained. Our total cost for service has been less than $200.00."

* (Name on request.)

Serviced by the United's exclusive "Instantaneous Service" Plan, our DISTRIBUTION PLAN offers an exceptional proposition to

Road Equipment Houses Everywhere

Write at once for information and descriptive literature. Some territory still open.

UNITED MOTORS PRODUCTS COMPANY

Grand Rapids **Michigan**

QUALITY TRUCKS SINCE 1910

Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constn. Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Olson & Co., Sam'l, Chicago, Ill.
Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., New York.
Stephens Adamson Mfg. Co., Aurora, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CONVEYORS, GRAVITY

Dow Co., Louisville, Ky.
Lamson Co., Syracuse, N. Y.
Mathews Gravity Carrier Co., Elwood City, Pa.
Standard Conveyor Co., No. St. Paul, Minn.

CRANES, LOCOMOTIVE

*Bay City Dredge Wks., Bay City, Mich.
*Koehring Co., Milwaukee, Wis.
*Osgood Co., The, Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravenna, O.
Davenport Locomotive Works, Davenport, Ia.
Erie Steam Shovel Co., Erie, Pa.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill.
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Thew Shovel Co., Lorain, O.
U. S. Crane Co., Chicago, Ill.

CRANES, OVERHEAD TRAVELING

*Curtis Pneumatic Mchy. Co., St. Louis, Mo.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
Alliance Machine Co., Alliance, O.
Chesapeake Iron Wks., Baltimore, Md.
Chisholm-Moore Mfg. Co., Cleveland, Ohio.
Milwaukee Electric Crane Co., Milwaukee, Wis.
Morgan Engineering Co., Alliance, O.
Northern Eng. Works, Detroit, Mich.
Shaw Crane Works, Muskegon, Mich.
Shepard Elec. Cr. & Hst. Co., Montour Falls, N.Y.
Toledo Crane Co., Bucyrus, O.
Whiting Fdry. & Equip. Co., Harvey, Ill.

CRANES, WRECKING

Bucyrus Co., South Milwaukee, Wis.
Industrial Works, Bay City, Mich.

CREOSOTED BLOCKS, TIMBER, ETC.

American Creosoting Co., Inc., New York.
American Creosote Works, Inc., N. Orleans, La.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Colonial Creosoting Co., Inc., New York.
Georgia Creosoting Co., New York.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Granite City, Ill.
Republic Creosoting Co., Indianapolis, Ind.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

CREOSOTING AND CREOSOTING OILS

Am. Creosote Wks., Inc., New Orleans, La.
American Tar Products Co., Chicago, Ill.
Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Slidell, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

CRUSHERS, HEAVY DUTY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buchanan Co., O. G., New York.
Traylor Eng. & Mfg. Co., Allentown, Pa.

CRUSHERS, ROCK

*Austin-Western Road Mach. Co., Chicago, Ill.
*Good Roads Machy. Co., Kennett Square, Pa.
*Universal Road Machinery Co., Kingston, N. Y.
Acme Road Machy. Co., Frankfort, N. Y.
Chalmers & Williams, Chicago Hts., Ill.
Galion Iron Works & Mfg. Co., Galion, Ohio
Morgan Engineering Co., Alliance, O.
New Holland Mach. Co., New Holland, Pa.
Smith Eng. Wks., Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Universal Crusher Co., Cedar Rapids, Ia.

CULVERTS, CAST IRON

*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmingham, Ala.
Gilbert Mfg. Co., Aberdeen, S. D.
Wood & Co., R. D., Philadelphia, Pa.

CULVERTS, CORRUGATED METAL

*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Good Reads Machinery Co., Kennett Square, Pa.
Canton Culvert & Silo Co., Canton, O.
Dominion Metal Products Corp., Roanoke, Va.
Florida Metal Products Co., Jacksonville, Fla.
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. D.
Hardesty Mfg. Co., The R., Denver, Colo.
Klauer Mfg. Co., Dubuque, Ia.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Newport Culvert Co., Newport, Ky.
Northfield Iron Co., Northfield, Minn.
Southern Metal Culvert Co., Salisbury, N. C.
Wheeling Corrugating Co., Wheeling, W. Va.

CULVERT FORMS

Concrete Form Co., Inc., Syracuse, N. Y.
Northfield Iron Co., Northfield, Minn.

CURB BOXES

*Clark Co., H. W., Mattoon, Ill.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Madison Foundry Co., Cleveland, O.
Mueller Co., Decatur, Ill.

CURB GUARDS, STEEL

*Godwin Co., W. S., Baltimore, Md.

CURB, STEEL PROTECTED

*Truscon Steel Co., Youngstown, O.
Concrete Steel Co., New York.
Steel Protected Concrete Co., Philadelphia, Pa.

CURING OF CONCRETE

*Dow Chemical Co., Midland, Mich.
*Solvay Process Co., Syracuse, N. Y.

CUTTERS, PIPE, HAND

Armstrong Mfg. Co., Bridgeport, Conn.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp'n., Greenfield, Mass.
Oswego Tool Co., Oswego, N. Y.
Reed Mfg. Co., Erie, Pa.
Walworth Mfg. Co., Boston, Mass.

CUTTERS, ROD AND WIRE

*Koehring Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Carolus Mfg. Co., Sterling, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Worthington Pump & Mchy. Corp., New York.

CUTTING EDGES

*Adams & Co., J. D., Indianapolis, Ind.
*Shunk Mfg. Co., Bucyrus, O.

CUTTING AND WELDING APPARATUS

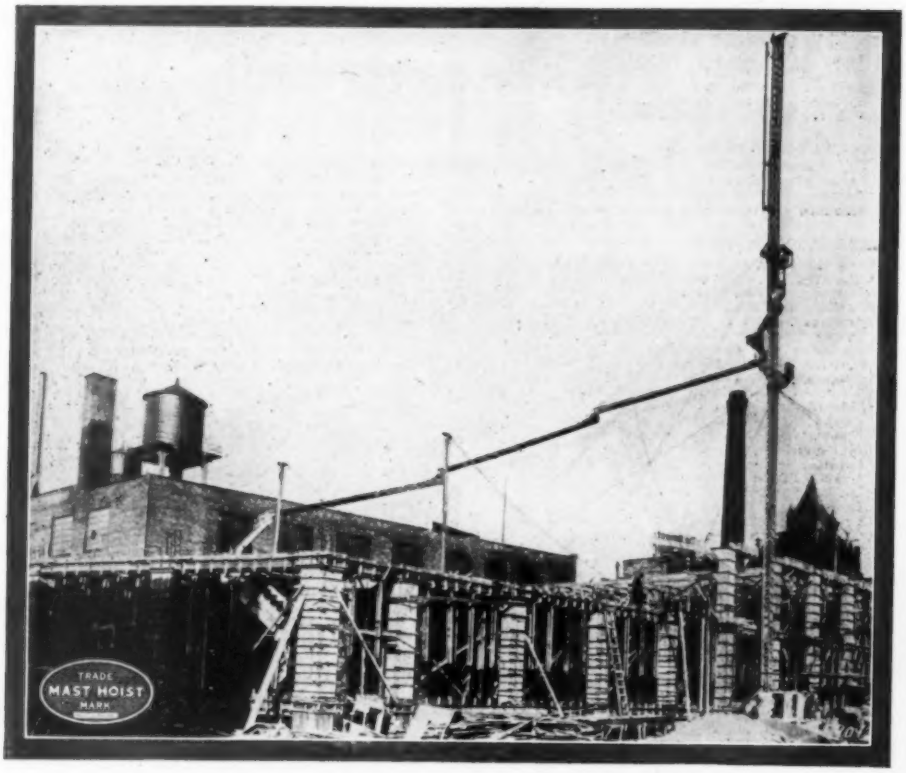
MacLeod Co., Cincinnati, O.
Milburn Co., Alexander, Baltimore, Md.

DERRICKS, GUY AND STIFF-LEG

*Insley Mfg. Co., Indianapolis, Ind.
American Hoist & Derrick Co., St. Paul, Minn.
Clyde Iron Wks. Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Flory Mfg. Co., S., Bangor, Pa.
Horton Co., John T., New York.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
National Hoisting Engine Co., Harrison, N. J.
Sasgen Derrick Co., Chicago, Ill.
Superior Iron Works, Superior, Wis.

DERRICKS, PIPE LAYING

Austin Machinery Corp'n, Muskegon, Mich.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.



A Concrete Handling Plant

For a 7-S or 14-S Mixer

THE Insley Steel Mast Boom Plant is designed for use on concrete work in which the yardage is insufficient to warrant a steel tower installation, but large enough so that chutes can be used advantageously. In general, jobs having between two hundred and three thousand yards fall in this class.

The Steel Mast Plant is made with two bucket sizes, to take the output of a 7-S or 14-S mixer. With the smaller size the day's output will be fifty to eighty yards. With the larger size it will be about a hundred and eighty yards a day. Either size will take care of all the output of a corresponding size mixer.

The smaller bucket can be had for either a wood or steel mast. When the wood mast is used, it is built by the user. This same bucket can later be put on a steel mast, if desired. The larger bucket can be used only on a steel mast.

The Steel Mast is designed for a maximum height of 140 feet, and is made in twenty-foot interchangeable sections. It is rigid enough so that the first thirty-foot section of chute can be tied back to it, eliminating an otherwise necessary chute support, giving in effect a free pouring radius of sixty feet. A sliding frame is provided which makes it possible to move the chute assembly to any desired level on the face of the mast.

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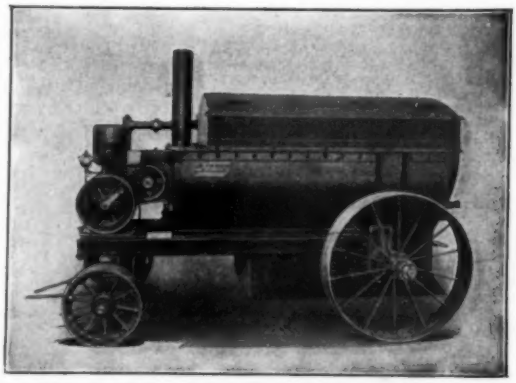

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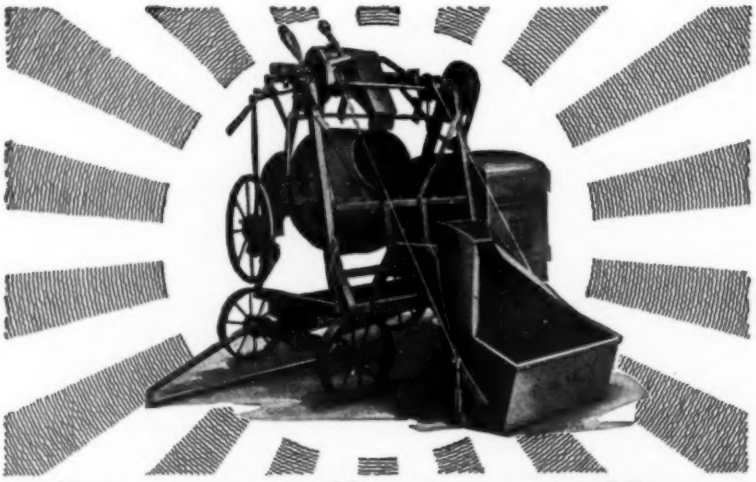

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Marine Decking & Supply Co., Phila., Pa.
Muller, Franklyn R., & Co., Waukegan, Ill.

FLOORS, WOOD BLOCK

*Barrett Co., New York.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Sou. Wood Preserving Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

FLUSH TANKS

Pacific Flush Tank Co., Chicago, Ill.

FLUSHERS, STREET. (See Street Flushers and Sprinklers.)

FORD AND FORDSON EQUIPMENT

AIR COMPRESSORS FOR FORDSONS

*Curtis Pneumatic Machinery Co., St. Louis, Mo.
Schramm, Inc., Westchester, Pa.

AIR COMPRESSORS FOR FORD TRUCKS

*Domestic Engine & Pump Co., Shippensburg, Pa.
Schramm, Inc., Westchester, Pa.

CONCRETE MIXERS ON FORD TRUCKS

*American Cement Machine Co., Keokuk, Iowa
Archer Iron Works, Chicago, Ill.
Milwaukee Concrete Mixer Co., Milwaukee, Wis.

DUMP BODIES FOR FORD TRUCKS

*Heil Co., Milwaukee, Wis.
*Stewart Iron Works Co., Cincinnati, Ohio
American Production & Trading Co., Chicago, Ill.
Anthony Co., Streator, Ill.
Archer Iron Wks., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Eagle Wagon Works, Auburn, N. Y.
Easton Car & Const'n Co., Easton, Pa.
Griscom-Russell, New York.
Hughes-Keenan Co., Mansfield, Ohio.
Jennings Auto. Dump Body Co., Roanoke, Va.
Lee Trailer & Body Co., Chicago, Ill.
Mandt Co., Koekuk, Iowa.
Martin-Parry Corp., York, Pa.
N. Y. Cent. Iron Wks. Co., Inc., Hagerstown, Md.
Pechstein Iron Works, Keokuk, Iowa.
Superior Boiler Works, Marion, Ind.
Thompson Mfg. Co., Williston, S. C.
Van Dorn Iron Works, Cleveland, Ohio.
Wood Hydr. Hoist & Body Co., Detroit, Mich.

FORD MOTOR PUMPER

Barton Products Co., Jackson, Mich.

FORD PLOWS

Roderick Lean Mfg. Co., Mansfield, Ohio.

FORD REPLACEMENT UNITS (AXLES AND TRANSMISSIONS)

*Hinckley Motors, Inc., Detroit, Mich.
*Warford Corpn., New York
Ruckstell Sales & Mfg. Co., Berkeley, Calif.

FORD SPECIAL BODIES

Standard Commercial Body Corp., B'klyn, N. Y.

FORD TRUCK EXTENSION FRAMES

Swedish Crucible Steel Co., Detroit, Mich.

FORDSON DITCHING MACHINE

Chas. T. Topping, Dayton, O.

FORDSON HOISTS

Clyde Iron Works Sales Co., Duluth, Minn.
Erated Machinery Mfg. Co., Portland, Oregon.
Oklahoma Eng. & Fdry. Co., Muskogee, Okla.
Otis Engine Corp., New York.
Sheffield Tool & Supply Co., Sheffield, Pa.

FORDSON INDUSTRIAL LOCOMOTIVES

*Brookville Truck & Tractor Co., Brookville, Pa.
Adamson Motor Co., Birmingham, Ala.
Whitehead & Kales Co., Detroit, Mich.

FORDSON ROAD GRADERS

*Good Roads Machinery Co., Kennett Square, Pa.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Adams, J. D. & Co., Indianapolis, Ind.
Gilbert Mfg. Co., Aberdeen, S. D.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Wehr Co., Milwaukee, Wis.

FORDSON ROAD ROLLERS

*Austin-Western Road Mach. Co., Chicago, Ill.
Galion Iron Works & Mfg. Co., Galion, Ohio

FORDSON SAW RIGS

Buddie Equipment Co., Cleveland, Ohio.

FORDSON SCRAPER OUTFITS

Killefer Mfg. Co., Los Angeles, Calif.
Miami Trailer Co., Troy, Ohio.
Miskin Scraper Works, Ucon, Idaho.
Gustav Schaefer Wagon Co., Cleveland, O.

FORDSON TRACTION TREADS

Full-Crawler Co., Milwaukee, Wis.
A. C. Johnson Products, Racine, Wis.

FORDSON TRACTOR TRUCKS

Toppins Tractor Truck Co., Appleton, Wis.

FORDSON TRAILER EQUIPMENT

Easton Car & Const'n Co., Easton, Pa.
Miami Trailer Co., Troy, Ohio.
Trail-Ford Corp., Ann Arbor, Mich.
Trailmobile Co., Cincinnati, O.
Troy Trailer & Wagon Co., Troy, O.
Whitehead & Kales Co., Detroit, Mich.

FORDSON TRUCK AND WAGON LOADERS

*George Haiss Mfg. Co., New York
*Spears-Wells Mach'y Co., Oakland, Cal.
Lessman Loader Mfg. Co., Des Moines, Iowa.
N. P. Nelson Iron Works, Brooklyn, N. Y.
Spears-Wells Machinery Co., Oakland, Calif.
Specialty Engineering Co., Philadelphia, Pa.

FORGES

Buffalo Forge Co., Buffalo, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.

FORM CLAMPS

*Insley Mfg. Co., Indianapolis, Ind.
Marion Malleable Iron Works, Marion, Ind.
Universal Form Clamp Co., Chicago, Ill.

FORMS, CONCRETE

*Blaw-Knox Co., Pittsburgh, Pa.
*Connery & Co., Philadelphia, Pa.
*Truscon Steel Co., Youngstown, O.
Concrete Form Co., Inc., Syracuse, N. Y.
Heltzel Steel Form & Iron Co., The, Warren, O.
Hotchkiss Steel Products Co., Binghamton, N. Y.
Lakewood Eng. Co., Cleveland, Ohio.
Metal Forms Corp., Milwaukee, Wis.

FOUNTAINS, DRINKING

Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, Jas. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Mott Iron Wks., J. L., New York.
Murdock Mfg. & Supply Co., Cincinnati, Ohio.
Puro San. Dr. Ftn. Co., Haydenville, Mass.
Rundle-Spence Mfg. Co., Milwaukee, Wis.
Stewart Iron Works Co., Cincinnati, O.
Taylor Co., Halsey W., Warren, O.
Twentieth Century Brass Wks., Belleville, Ill.

FURNITURE AND FILES, STEEL

Art Metal Constn. Co., Jamestown, N. Y.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works Co., Cleveland, O.

GARBAGE CANS. (See Cans)

GARBAGE DISPOSAL

American Beccari Corp., New York.
Balmer Corp., New York.
Bartlett, C. O. & Snow Co., Cleveland, O.
Decarie Incinerator Co., Long Island City, N. Y.
Jones & Very, New York.
Morse-Boulger Destructor Co., New York.
Nye Odorless Crematory Co., Macon, Ga.

GARBAGE TRUCKS AND BODIES

*Heil Co., Milwaukee, Wis.

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Tiffin Wagon Co., Tiffin, O.
Watson Products Corp., Canastota, N. Y.

GAS METERS. (See Meters, Gas.)

GAS PRODUCERS
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Wood & Co., R. D., Philadelphia, Pa.

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*Littleford Bros., Cincinnati, O.
Biggs Boiler Works, Akron, Ohio.
Birmingham Tank Co., Birmingham, Ala.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Byers Machine Co., Ravenna, Ohio.
Chicago Bridge & Iron Works, Chicago, Ill.
Graver Corp., East Chicago, Ind.
Scaife & Sons, Wm. B., Oakmont, Pa.
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United Iron Works, Inc., Kansas City, Mo.
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Chapman Valve Mfg. Co., Indian Orchard, Mass.
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Coldwell-Wilcox Co., Newburgh, N. Y.
Hardesty Mfg. Co., R., Denver, Colo.

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Bristol Co., Waterbury, Conn.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

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Simplex Valve & Meter Co., Philadelphia, Pa.

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*Shunk Mfg. Co., Bucyrus, Ohio.
Adams & Co., J. D., Indianapolis, Ind.

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Leavitt Mfg. Co., Urbana, Ill.
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Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Ingersoll-Rand Co., New York.

GYPSUM PRODUCTS
U. S. Gypsum Co., Chicago, Ill.

HAMMER DRILLS
(See Drills, Hammer.)

HAMMERS, STEAM, PILE. (See Pile Hammers, Steam)

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*Carey Co., Philip, Cincinnati, Ohio.
Johns-Manville, Inc., New York.

HEATING KETTLES. (See Kettles)

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American Hoist & Derrick Co., St. Paul, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Engine Co., J. S., Newark, N. J.
Street Bros. Mach. Wks., Chattanooga, Tenn.
Weller Mfg. Co., Chicago, Ill.

HOISTS, CONCRETE, TOWER
*Insley Mfg. Co., Indianapolis, Ind.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Lakewood Engineering Co., Cleveland, O.
Mead-Morrison Mfg. Co., E. Boston, Mass.

HOISTS, ELECTRIC
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Chisholm-Moore Mfg. Co., Cleveland, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
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Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Street Bros. Mach. Wks., Chattanooga, Tenn.
Treadwell Eng. Co., Easton, Pa.

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*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Construction Machy. Co., Waterloo, Iowa
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
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Clyde Iron Works Sales Co., Duluth, Minn.
Flory Mfg. Co., S., Bangor, Pa.
Lansing Co., Lansing, Mich.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Engine Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Novo Engine Co., Lansing, Mich.
O. K. Clutch & Mach. Co., Columbia, Pa.
Orr & Sembower, Reading, Pa.
Schramm, Inc., West Chester, Pa.
Street Bros. Mach. Wks., Chattanooga, Tenn.

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*Curtis Pneumatic Mchy. Co., St. Louis, Mo.
*Denver Rock Drill Mfg. Co., Denver, Colo.
Chicago Pneumatic Tool Co., New York.
Detroit Hoist & Machine Co., Detroit, Mich.
Hanna Eng. Works, Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Northern Engineering Works, Detroit, Mich.
Sullivan Mach'y Co., Chicago, Ill.
Worthington Pump & Machy. Corp., New York.

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*Denver Rock Drill Mfg. Co., Denver, Colo.
*Insley Mfg. Co., Indianapolis, Ind.
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Flory Mfg. Co., S., Bangor, Pa.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Orr & Sembower, Reading, Pa.
Treadwell Eng. Co., Easton, Pa.

HOISTS FOR MOTOR TRUCKS
*Heil Co., The, Milwaukee, Wis.
Rock Mfg. Co., Waterloo, N. Y.
Van Dorn Iron Wks., Cleveland, O.
Wood Hydr. Hoist & Body Co., Detroit, Mich.
(Horizontal Hydr. Hoist Co., Detroit, Mich.)

HOLLOW TILE
Bannon Pipe Co., P., Louisville, Ky.
Dee Co., Wm. E., Chicago, Ill.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Medal Paving Brick Co., Cleveland, Ohio.
Metropolitan Paving Brick Co., Canton, Ohio.
National Fireproofing Co., Pittsburgh, Pa.

HOPPERS, CONCRETE
*Insley Mfg. Co., Indianapolis, Ind.
*Littleford Bros., Cincinnati, O.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Lakewood Engineering Co., Cleveland, O.

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Republic Rubber Co., Youngstown, O.
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Bi-Lateral Fire Hose Co., Chicago, Ill.
Fabric Fire Hose Co., New York.
Goodrich Rubber Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, Ohio.
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HOUSES, PORTABLE. (See Buildings, Portable)

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*Ludlow Valve Mfg. Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
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Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve & Mfg. Co., Waterford, N. Y.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Norwod Engineering Co., Florence, Mass.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

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Rice Hydraulic Engine Co., New York.
Seattle Machine Works, Seattle, Wash.

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Carbondale Machine Co., Carbondale, Pa.
De La Vergne Machine Co., New York.
Frick Co., Inc., Waynesboro, Pa.
Triumph Ice Machine Co., Cincinnati, O.
United Iron Works, Inc., Kansas City, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
Vogt Mach. Co., Henry, Louisville, Ky.
York Mfg. Co., York, Pa.

INCINERATORS, GARBAGE. (See Garbage Disposal)

INDICATOR POSTS. (See Valves)

INSPECTING LABORATORIES
*Conard & Buxby, Burlington, N. J.
Allentown Testing Laboratories, Allentown, Pa.
Conwell & Co., E. L., Philadelphia, Pa.
Gulick-Henderson Co., New York.
Hunt & Co., Robert W., Chicago, Ill.
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Pittsburgh Testing Laboratories, Pittsburgh, Pa.
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Beckman Co., L., Toledo, Ohio.
Berger & Sons, C. L., Boston, Mass.
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Buff & Buff Mfg. Co., Boston, Mass.
Dietzgen Co., Eugene, Chicago, Ill.
Gurley, W. & L. E., Troy, N. Y.
Keuffel & Esser Co., Hoboken, N. J.
Lietz Co., A., San Francisco, Cal.
Leupold & Voelpel, Portland, Ore.
Weber & Co., F., Philadelphia, Pa.
White Co., David, Milwaukee, Wis.
Wissler Instrument Co., St. Louis, Mo.

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Bud Company, Chicago, Ill.
Duff Mfg. Co., Pittsburgh, Pa.
Joyce-Gridland Co., Dayton, O.
Norton, Inc., A. O., Boston, Mass.
Rees Mfg. Co., Pittsburgh, Pa.
Templeton, Kenly & Co., Ltd., Chicago, Ill.
Watson-Stillman Company, New York.

JACKS, PIPE FORCING
*Clark Co., H. W., Mattoon, Ill.
Duff Mfg. Co., Pittsburgh, Pa.

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Barnum Iron Works, E. T., Detroit, Mich.
Pauly Jail Bldg. Co., St. Louis, Mo.
Van Dorn Iron Works Co., Cleveland, O.

JOINTS, EXPANSION PAVING
(See Expansion Joint Material)

JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

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Acme Road Mach. Co., Frankfort, N. Y.
Aeroil Burner Co., Union Hill, N. J.
Birmingham Tank Co., Birmingham, Ala.
Chase & Lyman, Boston, Mass.
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Honhorst Co., Jos., Cincinnati, Ohio.
Macleod Co., Cincinnati, Ohio.
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Dietz Co., R. E., New York.
Handlan, Buck Mfg. Co., St. Louis, Mo.
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Berger Mfg. Co., Canton, O.
Bostwick Steel Lath Co., Niles, O.
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Milwaukee Corrugating Co., Milwaukee, Wis.
Northwestern Expanded Metal Co., Chicago, Ill.
Penn. Metal Co., Boston, Mass.
Sykes Metal Lath & Roofing Co., Niles, O.
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Chadborn & Coldwell Mfg. Co., Newburgh, N. Y.
Coldwell Lawn Mower Co., Newburgh, N. Y.
Ideal Power Lawn Mower Co., Lansing, Mich.
Jacobsen Mfg. Co., Racine, Wis.
Penna. Lawn Mower Works, Philadelphia, Pa.
Philadelphia Lawn Mower Co., Philadelphia, Pa.
Townsend Co., S. P., Bloomfield, N. J.
Western Implement Co., Port Washington, Wis.
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Canton Fdry. & Machy. Co., Canton, O.
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Pocht's Sons, Geo., Hoboken, N. J.
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Smith Mfg. Co., A. P., E. Orange, N. J.

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Hooker Electrochemical Co., New York.
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Not when indisputable evidence shows that it will save its cost after one big snow storm.

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Showing details of construction of Champion Snow Plow

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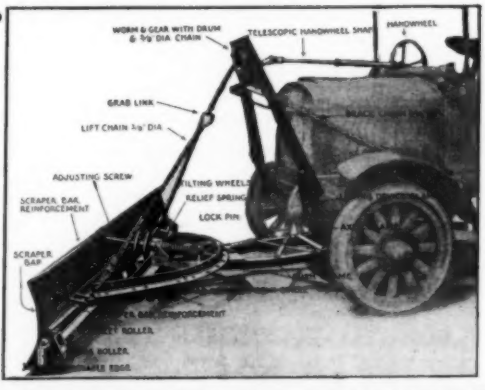

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Champion Snow Plow

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*Universal Road Machinery Co., Kingston, N. Y.
Austin Machinery Corp'n, Muskegon, Mich.
Bacon Co., Edw. R., San Francisco, Cal.
Barber-Greene Co., Aurora, Ill.
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Fairfield Engineering Co., Lancaster, Ohio.
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Nelson Iron Wks., Brooklyn, N. Y.
Portable Machy. Co, Passaic, N. J.
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Specialty Eng. Co., Philadelphia, Pa.
Weller Mfg. Co., Chicago, Ill.

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East Jersey Pipe Co., New York.

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Brookville Track & Tractor Co., Brookville, Pa.
Davenport Locomotive Works, Davenport, Ia.
Fate-Root-Heath Co., Plymouth, O.
Lima Locomotive Wks., Lima, O.
Industrial Equipment Co., Inc., Minster, O.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Porter Co., H. K., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

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Crowell & Spencer Lumber Co., Long Leaf, La.
Exchange Sawmills Sales Co., Kansas City, Mo.
Great Southern Lumber Co., Bogalusa, La.
Industrial Lumber Co., Elizabeth, La.
Long Bell Lumber Co., Kansas City, Mo.
Sargent Lumber Co., Little Rock, Ark.
Sterner Co., Inc., E. J., New York.
Weyerhaeuser Sales Co., Spokane, Wash.

LUMBER, STEEL
*Truscon Steel Co., Detroit, Mich.
Berger Mfg. Co., Canton, O.
General Fireproofing Co., Youngstown, O.
National Pressed Steel Co., Massillon, O.

MANHOLE COVERS. (See "Castings, Street")

METAL LATH. (See "Lath")

METAL ROOFING (See "Roofing")

METER BOXES
*Ford Meter Box Co., Wabash, Ind.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Mueller Company, Decatur, Ill.

METER COUPLINGS
*Ford Meter Box Co., Wabash, Ind.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., Pittsburgh, Pa.
*Union Water Meter Co., Worcester, Mass.
Clark Co., H. W., Mattoon, Ill.
Mueller Company, Decatur, Ill.

METER TESTERS
*Ford Meter Box Co., Wabash, Ind.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., Pittsburgh, Pa.
Clark Co., H. W., Mattoon, Ill.
Mueller Co., Decatur, Ill.
National Meter Co., New York.

METERS, ELECTRIC (WATTHOUR)
Duncan Elec. Mfg. Co., LaFayette, Ind.
General Electric Co., Schenectady, N. Y.
Sangamo Electric Co., Springfield, Ill.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

METERS, GAS
*Pittsburgh Meter Co., Pittsburgh, Pa.
American Meter Co., New York.
Bailey Meter Co., Cleveland, O.
Builders Iron Fdry., Providence, R. I.
Cleveland Gas Meter Co., Cleveland, O.

METERS, Water, Oil and Gasoline
*Badger Meter Mfg. Co., Milwaukee, Wis.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., Pittsburgh, Pa.
*Union Water Meter Co., Worcester, Mass.
Buffalo Meter Co., Buffalo, N. Y.
Federal Meter Co., Brooklyn, N. Y.
Gamon Meter Co., Newark, N. J.
Hersey Mfg. Co., Boston, Mass.
National Meter Co., New York.
Thomson Meter Co., Brooklyn, N. Y.
Worthington Pump & Mchy. Corp., New York.

METERS, WATER (VENTURI TYPE)
Builders Iron Foundry, Providence, R. I.
Simplex Valve & Meter Co., Philadelphia, Pa.

MIXERS, CONCRETE (See Concrete Mixers)

MIXERS, GROUT
*American Cement Mchy. Co., Inc., Keokuk, Ia.
Kent Machine Co., Kent, O.
Lakewood Engineering Co., Cleveland, O.
Union Iron Works, Inc., Hoboken, N. J.

MIXERS, HOT
*Barber Asphalt Co., Philadelphia, Pa.
*Koehring Co., Milwaukee, Wis.
Austin Machinery Corp'n, Muskegon, Mich.

MIXERS, MORTAR
*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Blaw-Knox Co., Pittsburgh, Pa.
*Construction Machinery Co., Waterloo, Ia.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Austin Machinery Corp'n, Muskegon, Mich.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
Kent Machine Co., Kent, O.
Knickerbocker Co., Jackson, Mich.
Lansing Co., Lansing, Mich.
Lakewood Engineering Co., Cleveland, Ohio.
Marsh-Capron Co., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.

MOTORCYCLES
Ace Motor Corp., Philadelphia, Pa.
Cleveland Motorcycle Co., Cleveland, Ohio.
Excelsior Motor Mfg. & Supply Co., Chicago, Ill.
Harley-Davidson Motor Co., Milwaukee, Wis.
Indian Motocycle Co., Springfield, Mass.

MOTORS, ELECTRIC (See Electric Generators and Motors)

MOTORS, GASOLINE
*Climax Engineering Co., Clinton, Iowa
*Hinckley Motors, Inc., Detroit, Mich.
Buda Co., Harvey, Ill.
Continental Motors Corp., Detroit, Mich.
Herschell-Spillman Co., No. Tonawanda, N. Y.
Waukesha Motor Co., Waukesha, Wis.
Wisconsin Motor Mfg. Co., Milwaukee, Wis.

MOTOR TRUCKS
*Ford Motor Co., Detroit, Mich.
*General Motors Truck Co., Pontiac, Mich.
*International Motor Co., New York.
*United Motor Products Co., Grand Rapids, Mich.
Acme Motor Truck Co., Cadillac, Mich.
Atterbury Motor Car Co., Buffalo, N. Y.
Autocar Co., Ardmore, Pa.
Bessemer Motor Truck Co., Grove City, Pa.
Brockway Motor Truck Co., Cortland, N. Y.
Clydesdale Motor Truck Co., Clyde, O.
Denby Motor Truck Co., Detroit, Mich.

On the National Boulevard

Scenes on the National Boulevard showing Fred Garrett, board member, and Edward Stigall, Supt. of the Springfield (Mo.) Special Road District. Only words of praise are heard for this excellent road.

STANOLIND PAVING ASPHALT "C"

IN the reconstruction of the fine highway pictured above Stanolind Paving Asphalt "C"—penetration method—was used. The general excellence of the road is clearly indicated by the photographs. Such roads as this are a benefit not only to the immediate community they serve, but also to the state as a whole, and the nation.

This stretch of road is near Springfield, Missouri. Formerly, it was a badly worn, rough, waterbound macadam pike. Now, since it has been resurfaced with Stanolind Paving Asphalt "C" it is one of the best and most inviting sections on the National Boulevard.

This fine, broad boulevard, as reconstructed and resurfaced, possesses all those qualities which every road builder recognizes as being of greatest importance. The surface is smooth, tough and offers great resistance to the wear of traffic. Comparatively, both its initial cost and the cost of maintenance are surprisingly low. Judged by any standard, a road or street constructed with Stanolind Paving Asphalt, properly applied, is the best that can be built. This company produces asphalts and road oils of different grades or properties, one of which will give the most satisfactory results. The selection of the product to be used is based on local conditions and local needs.

The engineers in our asphalt department, all with years of experience in road building, will gladly study your problems and assist you in formulating a really constructive road building program, based on your local conditions and local needs.

They have worked with others and in many instances have helped them effect great savings in the cost of road building. In every instance they are able to point the way to the securing of the greatest amount of good for the community from the money available for road work. No charge is made for this service, nor would it place you under obligations to us for you to avail yourself of their service.

At your request, we shall be pleased to send you our booklets relating to the betterment and permanent improvements of roads through the use of Standard Asphalt Road Oil and Stanolind Paving Asphalt.

STANDARD OIL COMPANY
(INDIANA)

904 S. Michigan Avenue CHICAGO, ILLINOIS

ILLINOIS	INDIANA	IOWA	S. DAKOTA	N. DAKOTA	MINNESOTA	MISSOURI
Chicago	Evansville	Davenport	Huron	Fargo	Duluth	Kansas City
Decatur	Indianapolis	Des Moines	MICHIGAN	Minot	Mankato	St. Joseph
Joliet	South Bend	Mason City	Detroit	WISCONSIN	Minneapolis	St. Louis
Peoria	KANSAS	Sioux City	Grand Rapids	La Crosse		
Quincy	Wichita		Saginaw	Milwaukee		

Diamond T. Motor Car Co., Chicago, Ill.
Duplex Truck Co., Lansing, Mich.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Garford Motor Truck Co., Lima, O.
Gramm Bernstein Truck Corp'n, Lima, O.
The Hug Co., Highland, Ill.
Indiana Truck Corp'n., Marion, Ind.
International Harvester Co., Chicago, Ill.
Kelly Springfield Motor Truck Co., Springfield, O.
Kissel Motor Car Co., Hartford, Wis.
Larrabee-Deyo Motor Tr. Co., Binghamton, N. Y.
Nash Motors Co., Kenosha, Wis.
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Copr'n, Buffalo, N. Y.
Traffic Motor Truck Co., St. Louis, Mo.
Transport Truck Co., Mt. Pleasant, Mich.
U. S. Motor Truck Co., Cincinnati, O.
White Co., Cleveland, Ohio.

MOULDS, CONCRETE

*Blaw Knox Co., Pittsburgh, Pa.

MUCKING MACHINES

Hoar Shovel Co., Duluth, Minn.

NUMBERS, HOUSE (See "House Numbers")

OAKUM

Wall Rope Works, Beverly, N. J.

OILS, ROAD

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Standard Oil Co., (Indiana), Chicago, Ill.
*Texas Company, New York.
Atlantic Refining & Asphalt Corp'n, Philadelphia
Headley Good Roads Co., Philadelphia, Pa.
Pierce Oil Corp., New York.
Pioneer Asphalt Co., Lawrenceville, Ill.
Sinclair Refining Co., Chicago, Ill.
Standard Oil Co., (La.) New Orleans, La.
Standard Oil Co., (N. J.), Newark, N. J.
Standard Oil Co. (N. Y.), New York.
U. S. Asphalt Refining Co., New York.

OXY-ACETYLENE APPARATUS

Oxweld Acetylene Co., Newark, N. J.

OXYGEN

Linde Air Products Co., New York.

PACKING, WATER PIPE

*Union Water Meter Co., Worcester, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Company, New York.

PAINT GUNS

Spray Painting & Finishing Equipment Sales Co., Boston, Mass.

PAINTS, METAL PROTECTION

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Dixon Crucible Co., Jos., Jersey City, N. J.
*Solvay Process Co., Syracuse, N. Y.
Acme White Ld. & Col. Works, Detroit, Mich.
Berry Bros., Detroit, Mich.
Cook Paint & Varnish Co., Kansas City, Mo.
Detroit Graphite Co., Detroit, Mich.
Detroit White Lead Wks., Detroit, Mich.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Minwax Co., New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Sherwin-Williams Co., Cleveland, O.
Sonneborn Sons, Inc., L., New York.
Toch Bros., New York.
Tropical Paint & Oil Co., Cleveland, Ohio.
Truscon Laboratories, Detroit, Mich.

PAPERS, BLUE PRINT AND BROWN PRINT

Indianapolis Blue Print & Supply Co., Indianapolis, Ind.

PAPER, BUILDING, ROOFING, ETC.

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
Bird & Son, inc., E. Walpole, Mass.
Brown Co., Portland, Me.
Hydrex Asphalt Products Corp., New York.
Johns-Manville, Inc., New York.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.

PARK BENCHES

*Stewart Iron Works Co., Cincinnati, O.
Art Concrete Works, Pasadena, Calif.
Bausman Mfg. Co., Millersville, Pa.
Dow Co., Louisville, Ky.
Meyers Mfg. Co., Fred J., Hamilton, Ohio.
Mott Iron Wks., J. L., New York.

PAVING AND ROAD ROLLERS. (See Road and Paving Rollers)

PAVING BLOCKS, CREOSOTED WOOD

America Creosote Wks., Inc., New Orleans, La.
Carter Bloxonend Flooring Co., Kansas City, Mo
Creosoted Materials Co., New Orleans, La.
Republic Creosoting Co., Indianapolis, Ind.
Wyckoff Pipe & Creosoting Co., New York.

PAVING BRICK

Albion Shale Brick Co., Albion, Ill.
Alton Brick Co., Alton, Ill.
Barr Clay Co., Streator, Ill.
Binghamton Brick Co., Binghamton, N. Y.
Burton Townsend Co., Zanesville, N. Y.
Cleveland Brick & Clay Co., Cleveland, O.
Clydesdale Brick & Stone Co., Pittsburgh, Pa.
Coffeyville Vit. Brick & Tile Co., Coffeyville, Kans.
Corry Brick & Tile Corp., Corry, Pa.
Flint Brick Co., Des Moines, Ia.
Francis Vit. Brick Co., Boynton, Okla.
Georgia Brick & Tile Co., Adairsville, Ga.
Hammond Fire Brick Co., Fairmont, W. Va.
Hooking Valley Brick Co., Columbus, O.
Hydraulic Press Brick Co., St. Louis, Mo.
Independence Pav. Br. Co., Independence, Kans.
McAvoy Vit. Brick Co., Philadelphia, Pa.
Mack Mfg. Co., Wheeling, W. Va.
Mayer Brick Co., C. P., Bridgeville, Pa.
Medal Paving Brick Co., Cleveland, O.
Metropolitan Paving Brick Co., Canton, O.
Mineral Wells Pav. Brick Co., Mineral Wells, Tx.
Moberly Paving Brick Co., Moberly, Mo.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Patton Clay Mfg. Co., Patton, Pa.
Peebles Brick Co., Portsmouth, O.
Penna. Clay Co., Pittsburgh, Pa.
Pittsburgh Paving Brick Co., Pittsburgh, Kans.
Poston Paving Brick Co., Crawfordsville, Ind.
Purington Paving Brick Co., Galesburg, Ill.
Southern Clay Mfg. Co., Chattanooga, Tenn.
Springfield Paving Brick Co., Springfield, Ill.
Sterling Brick Co., Olean, N. Y.
Streator Clay Mfg. Co., Streator, Ill.
Thornton Fire Brick Co., Clarksburg, W. Va.
Thurber Brick Co., Thurber, Texas.
Toronto Fire Clay Co., Toronto, Ohio.
Trinidad Brick & Tile Co., Trinidad, Ohio.
Veedersburg Paving Brick Co., Veedersburg, Ind.
Western Clay Mfg. Co., Helena, Mont.
Westport Paving Brick Co., Westport, Md.

PAVING MACHINERY. (See Road and Paving Machinery)

PAVING GUARDS, STEEL

*Godwin Co., W. S., Baltimore, Md.
International Steel Tie Co., Cleveland, O.

PAVING MATERIALS. (See "Asphalt," "Paving Brick," "Granite Block," etc.)

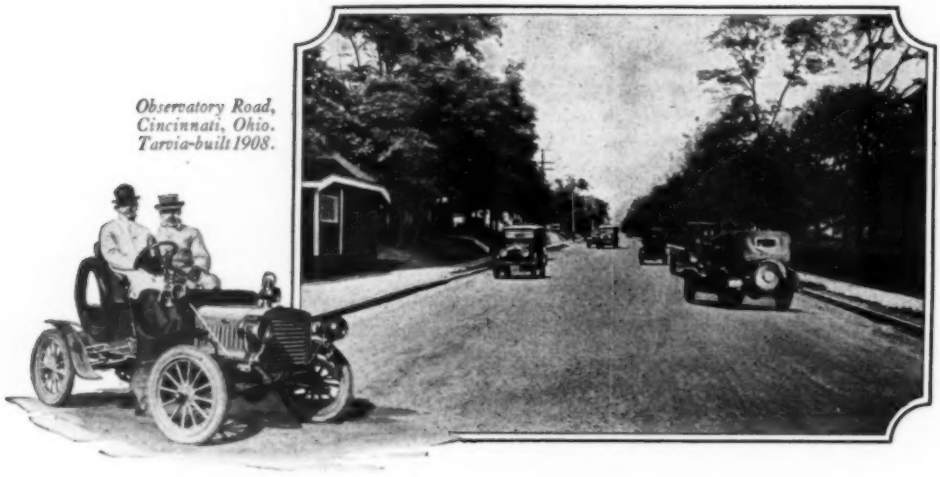
PAVING MIXERS. (See Concrete Mixers)

PAVING TOOLS

*Barber Asphalt Co., Philadelphia, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Littleford Bros. Co., Cincinnati, O.
*Warren Bros. Co., Boston, Mass.
Aeroil Burner Co., Union Hill, N. J.
Anderson Tool & Sup. Co., W. H., Detroit, Mich
Cummer & Sons Co., F. D., Cleveland, O.
Union Iron Works, Hoboken, N. J.

PERFORATED METALS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.



Observatory Road, Cincinnati, Ohio. Tarvia-built 1908.

Traffic doubled and redoubled many times —but the Tarvia street is still good

IN 1908 they built the Tarvia pavement on Observatory Road. Motorists found it smooth —always free from mud and dust.

The old cars have gone their way—motor traffic has doubled and redoubled many times. But after sixteen years of this ever-increasing grind, Observatory Road's Tarvia pavement is still good.

Tarvia pavement can be kept good indefinitely at little cost. And in addition: A Tarvia pavement will not wave, roll or rut. A Tarvia pavement is skidproof, because of its granular surface.

Thousands of Tarvia streets and roads have proved to taxpayers that—for the money spent—Tarvia gives more miles and the most years of satisfactory highway service. On request, we will gladly send you illustrated booklets, construction data and complete specifications.

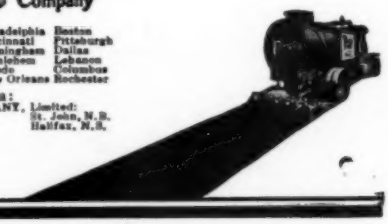
Tarvia
For Road Construction Repair and Maintenance

The Barrett Company

New York	Chicago	Philadelphia	Boston
St. Louis	Cleveland	Cincinnati	Pittsburgh
Detroit	Kansas City	Birmingham	Dallas
Minneapolis	Salt Lake City	Bethlehem	Lebanon
Youngstown	Milwaukee	Toledo	Columbus
Baltimore	Syracuse	New Orleans	Rochester

In Canada:
THE BARRETT COMPANY, Limited:

Montreal	Toronto	St. John, N.B.
Winnipeg	Vancouver	Halifax, N.S.



PICKS

Beall Tool Co., East Alton, Ill.
Hubbard Co., Pittsburgh, Pa.
Iron City Tool Works, Pittsburgh, Pa.
Klein-Logan Co., Pittsburgh, Pa.
Verona Tool Works, Verona, Pa.
Warren Tool & Forge Co., Warren, O.
Warwood Tool Co., Wheeling, W. Va.
Wyoming Shovel Wks., Wyoming, Pa.

PILE DRIVERS

*McKiernan-Terry Drill Co., New York.
Browning Co., Cleveland, O.
Clyde Iron Works Sales Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
Lidgerwood Manufacturing Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
McMyler Interstate Co., Cleveland, O.
Union Iron Works, Hoboken, N. J.

PILE HAMMERS, STEAM

*McKiernan-Terry Drill Co., New York.
Clyde Iron Works Sales Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
National Hoisting Eng. Co., Harrison, N. J.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Chicago, Ill.

PILING, CONCRETE

MacArthur Concrete Pile & Foundation Co., N. Y.
Raymond Concrete Pile Co., New York.

PILING, INTERLOCKING STEEL

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.

PIPE, CAST IRON

*Central Foundry Co., New York.
*National Cast Iron Pipe Co., Birmingham, Ala.
*U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmingham, Ala.
Clow & Sons, J. B., Chicago, Ill.
Donaldson Iron Co., Emaus, Pa.
Fox & Co., John, New York.
Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
Lynchburg Foundry Co., Lynchburg, Va.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Warren Fdry. & Machine Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

PIPE, CULVERT. (See Culverts)

PIPE, LEAD

United Lead Company, New York.

PIPE, REINFORCED CONCRETE

Concrete Products Co., Pittsburgh, Pa.
Core Joint Concrete Pipe Co., Baltimore, Md.
Independent Concrete Pipe Co., Indianapolis, Ind.
Lock Joint Pipe Co., E. Orange, N. J.
Massey Concrete Products Corp'n, Chicago, Ill.
Newark Concrete Pipe Co., Newark, N. J.

PIPE, RIVETED STEEL

*Blaw-Knox Co., Pittsburgh, Pa.
*Conery & Co., Inc., Philadelphia, Pa.
*Littleford Bros., Cincinnati, Ohio.
Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.
Canton Culvert & Silo Co., Canton, O.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
East Jersey Pipe Co., New York.
Hammond Iron Works, Warren, Pa.
Hardesty Mfg. Co., R., Denver, Colo.
Honhorst Co., Jos., Cincinnati, Ohio.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Tippet & Wood, Phillipsburg, N. J.
Welter Mfg. Co., Chicago, Ill.

PIPE, SPIRAL RIVETED

Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.

PIPE, STEEL

Central Tube Co., Pittsburgh, Pa.
East Jersey Pipe Co., New York.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Spang-Chalfont & Co., Pittsburgh, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, WOOD

American Wood Pipe Co., Tacoma, Wash.
Continental Pipe Mfg. Co., Seattle, Wash.
Michigan Pipe Co., Bay City, Mich.
Pacific Tank & Pipe Co., San Francisco, Cal.
Redwood Mfrs. Co., San Francisco, Cal.
Standard Wood Pipe Co., Williamsport, Pa.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE, WROUGHT IRON

Byers Co., A. M., Pittsburgh, Pa.
Reading Iron Co., Reading, Pa.

PIPE BENDING MACHINES

Amer. Pipe Bending Mach. Co., Boston, Mass.
Walworth Mfg. Co., Boston, Mass.

PIPE COVERING

AIRCELL

*Carey Co., Philip, Cincinnati, Ohio.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.
Nat'l Asbestos Co., Jersey City, N. J.
Norristown Mag. & Asb. Co., Norristown, Pa.
Sall Mt. Co., Chicago, Ill.
Watson Co., H. F., Erie, Pa.

85 PER CENT MAGNESIA

*Carey Co., Philip, Cincinnati, Ohio.
Ehret Magnesia Co., Valley Forge, Pa.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.

WOOD

Continental Pipe Mfg. Co., Seattle, Wash.
Redwood Mfrs. Co., San Francisco, Cal.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE CUTTERS. (See Cutters, Pipe, Hand.)

PIPE FITTINGS

*Central Foundry Co., New York.
*Nat'l Cast Iron Pipe Co., Birmingham, Ala.
*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
American C. I. Pipe Co., Birmingham, Ala.
Builders Iron Fdry., Providence, R. I.
Clow & Sons, J. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Reading Steel Casting Co., Inc., Bridgeport, Conn
Warren Fdry. & Mach. Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

PIPE HANDLING MACHINERY

Mueller Company, Decatur, Ill.
Taylor Portable Steel Derrick Co., Chicago, Ill.

PIPE JOINT COMPOUND. (Sewer)

*Carey Co., Philip, Cincinnati, Ohio.
*Waring-Underwood Co., Philadelphia, Pa.
G. K. Sales Co., Macungie, Pa.
Leadite Company, Inc., Philadelphia, Pa.
Pacific Flush Tank Co., Chicago, Ill.
Ruberoid Co., New York.

PIPE JOINT MATERIAL. (Cast Iron)

Lead-Hydro-Tite Co., Boston, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Co., New York.

PLAYGROUND APPARATUS

American Playground Device Co., Anderson, Ind.
Everwear Mfg. Co., Springfield, O.
Exerswing Co., Minneapolis, Minn.
George, Howard, Philadelphia, Pa.
Hill-Standard Co., Anderson, Ind.
Medart Mfg. Co., Fred., St. Louis, Mo.
Patterson, Williams Co., San Jose, Calif.
Spalding & Bros., A. G., Chicopee, Mass.

PLOWS, CONTRACTORS

*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.
*Holt Mfg. Co., Peoria, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.

Another big job for

McKIERNAN-TERRY HAMMERS

Five 9-B's driving 18,000 piles for the foundation of the New York Edison Power Plant

The work for this $30,000,000 plant, at 14th Street and East River, New York City, is being handled by the P. T. Cox Contracting Company. It involves, at present, 18,000 wood piles, spaced 2-ft. 6-in. centers, driven as a mat covering two city blocks. Piles average 30 ft. penetration, the majority with points 8 in. to 11 in. diameter, with butts up to 16 in. The driving is very hard, into a dense, heavy mixture of coarse sand and clay.

"We have been easily maintaining 50 piles per 8-hour day per hammer," writes the P. T. Cox Contracting Company. "We have found McKiernan Terry 9-B Hammers very satisfactory in every respect."

The equipment on the job consists of five 9-B Hammers, operated in two travelers with swinging leads, each operating two hammers; and one land rig. Note perfect condition of pile butts in photograph.

Bulletin 31 describes all McKiernan-Terry Hammers.

McKiernan-Terry Drill Company

Rock Drills Pile Hammers Lifting Jacks
Mining and Quarrying Machinery

19 Park Row, New York
Works at Dover, N. J.

Agencies in the following cities: Boston, Chicago, Pittsburgh, Cleveland, Detroit, St. Paul, San Francisco, Columbus, O., New Orleans, Philadelphia, Portland, Oregon.

Foreign Representatives: British Steel Piling Co., London, England.

American Steel Scraper Co., Sidney, O.
Deere & Co., Moline, Ill.
International Harvester Co., Chicago, Ill.
Moline Plow Co., Rock Island, Ill.
Oliver Chilled Plow Works, South Bend, Ind.
Sidney Steel Scraper Co., Sidney, O.
Slusser-McLean Scraper Co., Sidney, O.
Smith & Sons Mfg. Co., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.
Wiard Plow Co., Batavia, N. Y.

PLUMBING SUPPLIES

Clow & Sons, J. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Glauber Brass Mfg. Co., Cleveland, O.
Mott Iron Wks., J. L., New York.
Mueller Company, Decatur, Ill.
Rundle-Spence Mfg. Co., Milwaukee, Wis.
United Brass Mfg. Co., Cleveland, O.
Walworth Mfg. Co., Boston, Mass.

POLES, STEEL STRUCTURAL

*Blaw-Knox Co., Pittsburgh, Pa.
Electric Railway Equipment Co., Cincinnati, O.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

PORTABLE BUILDINGS

*Blaw-Knox Co., Pittsburgh, Pa.
*Littleford Bros., Cincinnati, Ohio.
*Truscon Steel Co., Youngstown, O.
Kolb Building Co., New York.
Milwaukee Corrugating Co., Milwaukee, Wis.

PORTABLE STEEL DERRICKS. (See Derricks, Steel Portable.)

PORTLAND CEMENT. (See Cement.)

POWDER. (See Explosives.)

POWER PLANTS, INDUSTRIAL

*Climax Engineering Co., Clinton, Iowa

PUMPS, AIR LIFT

*American Steam Pump Co., Battle Creek, Mich.
Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

PUMPS, BOILER FEED

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Steam Pump Co., Battle Creek, Mich.
Aurora Pump & Mfg. Co., Aurora, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Works, A. S., New York
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Co., Indianapolis, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
LeCourtenay Co., Newark, N. J.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Northern Fire Apparatus Co., Minneapolis, Minn.
Scranton Pump Co., Scranton, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Vogt Bros. Mfg. Co., Louisville, Ky.
Warren Steam Pump Co., Warren, Mass.
Weinman Pump Mfg. Co., Columbus, O.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

*American Steam Pump Co., Battle Creek, Mich.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Keystone Driller Co., Beaver Falls, Pa.
*Novo Engine Co., Lansing, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Steam Pump Works, A. S., New York.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Erie Pump & Engine Works, Medina, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
LeCourtenay Co., Newark, N. J.
Manistee Iron Wks., Manistee, Mich.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Schramm, Inc., West Chester, Pa.
Tokheim Oil Tank & Pump Co., Ft. Wayne, Ind.
United Iron Works, Inc., Kansas City, Mo.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mchy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONTRACTORS'

*American Steam Pump Co., Battle Creek, Mich.
*Construction Mach'y Co., Waterloo, Ia.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Kinney Mfg. Co., Boston, Mass.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Buda Co., Harvey, Ill.
Cameron Steam Pump Works, A. S., New York.
Carter Co., Ralph B., New York.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
Dayton-Dowd Co., Quincy, Ill.
Deming Co., Salem, Ohio.
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
LeCourtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Myers & Bro. Co., F. E., Ashland, O.
Northern Fire App. Co., Minneapolis, Minn.
Novo Engine Co., Lansing, Mich.
Pulsometer Steam Pump Co., New York.
Schramm, Inc., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
Standard Scale & Supply Co., Pittsburgh, Pa.
Van Nouhuys Machine Wks., Albany, N. Y.
Waldo Bros. & Bond Co., Boston, Mass.

PUMPS, DEEP WELL

*Aldrich Pump Co., Allentown, Pa.
*American Steam Pump Co., Battle Creek, Mich.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Keystone Driller Co., Beaver Falls, Pa.
American Well Works, Aurora, Ill.
Cameron Steam Pump Works, A. S., New York.
Clark Co., H. W., Mattoon, Ill.
Cook, Inc., A. D., Lawrenceburg, Ind.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Layne & Bowler Co., Memphis, Tenn.
McDonald Mfg. Co., A. Y., Dubuque, Ia.
Midwest Engine Co., Indianapolis, Ind.
Myers & Bro. Co., F. E., Ashland, O.
United Iron Works, Inc., Kansas City, Mo.
Weber Subterranean Pump Co., New York.

PUMPS, DREDGING

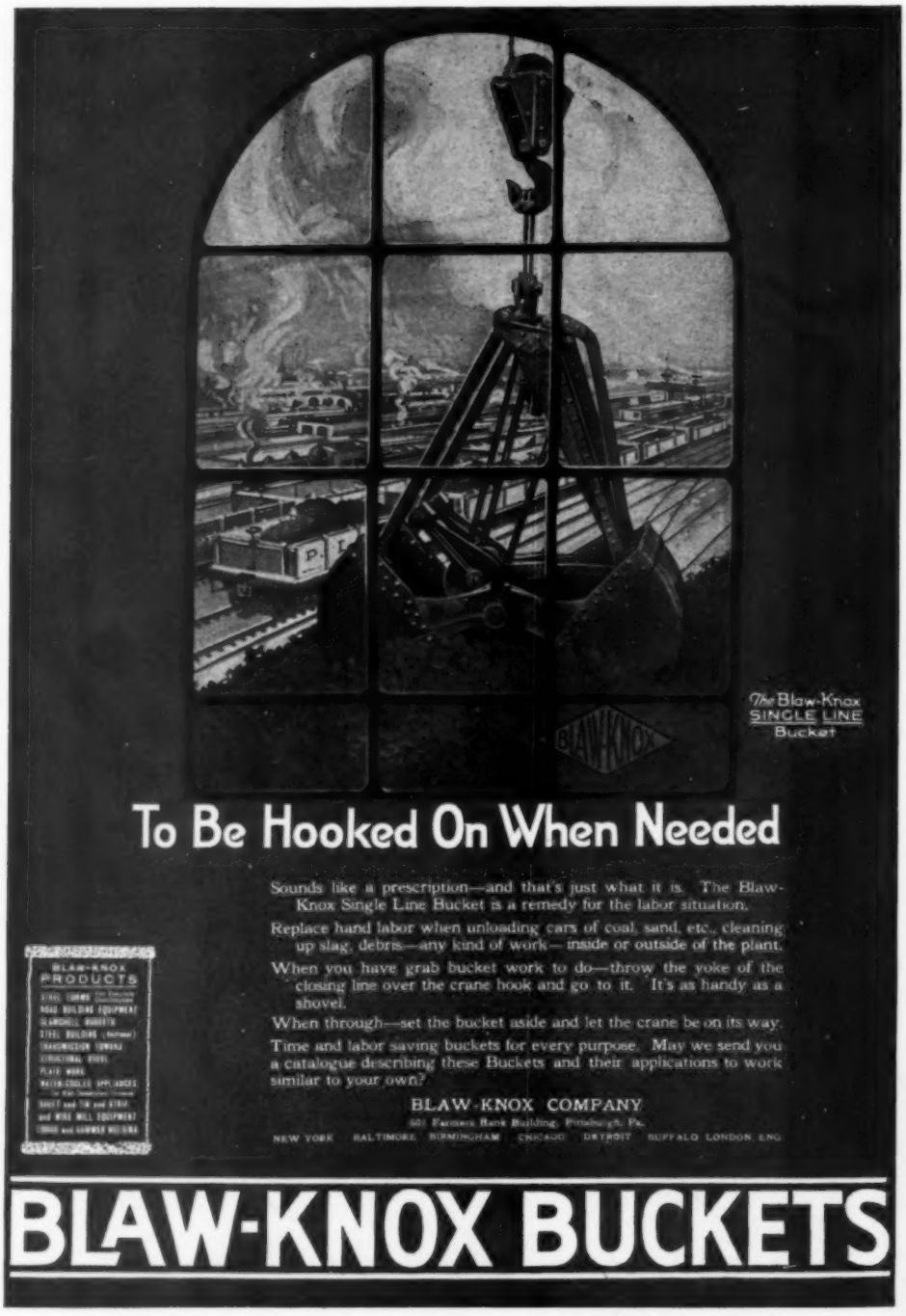
*Aldrich Pump Co., Allentown, Pa.
*American Steam Pump Co., Battle Creek, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Ellicott Machine Corp., Baltimore, Md.
Erie Pump & Engine Co., Medina, N. Y.
Morris Machine Works, Baldwinsville, N. Y.
Worthington Pump & Mchy. Corp., New York.

PUMPS, GASOLINE AND OIL

*Kinney Mfg. Co., Boston, Mass.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Wayne Tank & Pump Co., Fort Wayne, Ind.

PUMPS, POWER

*Kinney Mfg. Co., Boston, Mass.
*Koehring Co., Milwaukee, Wis.
*Novo Engine Co., Lansing, Mich.
Alamo Iron Works, San Antonio, Tex.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Steam Pump Co., Battle Creek, Mich.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippenburg, Pa.
Evinrude Motor Co., Milwaukee, Wis.



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Replace hand labor when unloading cars of coal, sand, etc., cleaning up slag, debris—any kind of work—inside or outside of the plant.

When you have grab bucket work to do—throw the yoke of the closing line over the crane hook and go to it. It's as handy as a shovel.

When through—set the bucket aside and let the crane be on its way.

Time and labor saving buckets for every purpose. May we send you a catalogue describing these Buckets and their applications to work similar to your own?

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Le-Courtenay Co., Newark, N. J.
McGown Co., J. H., Cincinnati, O.
Myers & Bro. Co., F. E., Ashland, O.
Nordberg Mfg. Co., Milwaukee, Wis.
Northern Fire Apparatus Co., Minneapolis, Minn.
Weinman Pump Mfg. Co., Columbus, O.
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Yoemans Bros. Co., Chicago, Ill.

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Carnegie Steel Co., Pittsburgh, Pa.
Easton Car & Const'n Co., Easton, Pa.
Sweet's Steel Co., Williamsport, Pa.

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Gurley, W. & L. E., Troy, N. Y.

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REINFORCING CONCRETE. (See Concrete Reinforcements.)

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Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Watson-Stillman Co., New York.

RIVET SETS

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Dunbar Drop Forge Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.

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*Austin-Western Road Mchy. Co., Chicago, Ill.
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*Good Roads Mach'y Co., Kennett Square, Pa.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Stockland Road Mach. Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. D.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Monroe & Sons, N. S., Arthur, Ill.
Shaw-Enochs Tractor Co., Minneapolis, Minn.
Smith & Sons Mfg. Co., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.

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*Good Roads Mach'y Co., Kennett Square, Pa.
*International Motor Co., New York.
*Kinney Mfg. Co., Boston, Mass.
*Littleford Bros., Cincinnati, O.
*Spears-Wells Mach'y Co., Oakland, Cal.
Etnyre & Co., E. D., Oregon, Ill.
White Co., Cleveland, O.

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*Acme Road Mach. Co., Frankfort, N. Y.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*East Iron & Machine Co., Lima, Ohio.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Stockland Road Machy. Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.
Avery Co., Peoria, Ill.
Case Threshing Machine Co., J. I., Racine, Wis.
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. D.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Miami Trailer-Scraper Co., Troy, Ohio.
Root Spring Scraper Co., Kalamazoo, Mich.
Sidney Steel Scraper Co., Sidney, O.
Smith & Sons Mfg. Co., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.

ROAD AND PAVING ROLLERS

*Austin-Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Mach. Co., Kennett Square, Pa.
*Huber Mfg. Co., Marion, O.
Case Threshing Machine Co., J. I., Racine, Wis.
Erie Machine Shops, Erie, Pa.
Galion Iron Works & Mfg. Co., Galion, Ohio

ROAD AND PAVING MACHINERY

*Atlas Engineering Co., Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Barber Asphalt Co., Philadelphia, Pa.
*Blaw-Knox Co., Pittsburgh, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Connery & Co., Inc., Philadelphia, Pa.
*East Iron & Mach. Co., Lima, Ohio.
*Equitable Asph. Maint. Co., Kansas City, Mo.
*Good Roads Mach. Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Holt Mfg. Co., Peoria, Ill.
*International Motor Co., New York.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Spears-Wells Machy. Co., Oakland, Cal.
*Stockland Road Mach. Co., Minneapolis, Minn.
*Universal Road Mchy. Co., Kingston, N. Y.
Acme Road Mach. Co., Frankfort, N. Y.
Adams & Co., J. D., Indianapolis, Ind.
Austin Machinery Corp'n, Muskegon, Mich.
Bucyrus Road Machy. Co., Bucyrus, O.
Case Threshing Machine Co., J. I., Racine, Wis.
Cummer & Son Co., F. D., Cleveland, O.
Easton Car & Const'n Co., Easton, Pa.
Edwards Mfg. Co., C. D., Albert Lea, Minn.
Erie Machine Shops, Erie, Pa.
Farasey Co., J. D., Cleveland, Ohio
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. Dak.
Glide Road Mach'y Co., Minneapolis, Minn.
Honhorst Co., Jos., Cincinnati, O.
Lakewood Engineering Co., Cleveland, O.
Lyle Culv. & Rr. Equip. Co., Minneapolis, Minn.
Monroe & Sons, N. S., Arthur, Ill.
Northfield Iron Co., Northfield, Minn.
Smith Co., T. L., Milwaukee, Wis.
Smith & Sons Mfg. Co., Kansas City, Mo.
United Iron Works, Inc., Kansas City, Mo.

ROCK CRUSHERS AND PULVERIZERS (See "Crushers")

ROCK DRILLS. (See Drills, Rock.)

ROOFING, ASPHALT, COMPOSITION, TILE, ETC.

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Co., New York.
American Cement Tile Mfg. Co., Pittsburgh, Pa.
Atlantic Refining & Asphalt Corp., Phila., Pa.
Beaver Products Co., inc., Buffalo, N. Y.
Bird & Son, Inc., E. Walpole, Mass.
Certain-teed Products Corp., New York.
Chatfield Mfg. Co., Cincinnati, Ohio.
Edwards Mfg. Co., Cincinnati, O.
Flintkote Co., Boston, Mass.
Johns-Manville, Inc., New York.
Keystone Roofing Mfg. Co., York, Pa.
Lehon Co., The, Chicago, Ill.
Lewis Mfg. Co., F. J. Chicago, Ill.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.
Sall Mountain Co., Chicago, Ill.
Sifo Products Co., St. Paul, Minn.
Sonneborn & Sons, Inc., L., New York.
United States Gypsum Co., Chicago, Ill.
Western Elaterite Roofing Co., Denver, Colo.

ROOFING, METAL

*Truscon Steel Co., Youngstown, O.

Concrete Curing Problems Solved

The actual making of concrete begins when water is added to the dry ingredients in the mix. The physical and chemical action starts immediately and must continue long after the concrete is poured to secure tough, enduring pavements.

The curing process is a means to maintain the required supply of moisture until the action within the cement is finished. Moisture enables the stone making process to work itself to completion.

The first methods of getting and holding moisture were awkward. They involved the work of men with pipelines, pumps and hose. Grading, scraping, banking and earth removal were costly and time consuming.

The modern method removes all these obstacles. It does the same thing as the old-fashioned, awkward, costly methods.

One man can quickly apply Dowflake to the full day's mixer run. Dowflake is a clean, odorless chemical Salt. As soon as spread on the pavement it begins drawing moisture from the air. It absorbs several times its weight and holds moisture in contact with the pavement. It cures completely and efficiently. Though it cures in a fraction of the usual time it does not affect the ultimate strength. State Departments have tested and approved. The antiquated curing methods cannot be compared with the use of Dowflake as a curing agent. Dowflake's accelerating and anti-freeze properties make it invaluable for cold weather concrete work. Write for our book—"How To Cure Concrete."

The Dow Chemical Company

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Amer. Sheet & Tin Plate Co., Pittsburgh, Pa.
Berger Mfg. Co., Canton, O.
Edwards Mfg. Co., Cincinnati, O.
Klauer Mfg. Co., Dubuque, Ia.
Milwaukee Corrugating Co., Milwaukee, Wis.
Nat'l Sheet Metal Roofing Co., Jersey City, N. J.
United Alloy Steel Corpn., Canton, O.
Youngstown Sheet & Tube Co., Youngstown, O.

ROOFING KETTLES. **(See Kettles)**

ROPE, MANILA

American Mfg. Co., Brooklyn, N. Y.
Columbian Rope Co., Auburn, N. Y.
Cupples Cordage Co., Brooklyn, N. Y.
Hooven & Allison Co., Xenia, O.
Kelly Co., R. A., Xenia, O.
New Bedford Cordage Co., New Bedford, Mass.
Peoria Cordage Co., Peoria, Ill.
Plymouth Cordage Co., N. Plymouth, Mass.
Wall Rope Wks., New York.
Waterbury Co., New York.
Whitlock Cordage Co., New York.

ROPE, WIRE, HOISTING, HAULAGE

*Wickwire Spencer Steel Corp., New York.
*Williamsport Wire Rope Co., Williamsport, Pa.
American Steel & Wire Co., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.
MacWhyte Co., Kenosha, Wis.
Moon Co., Geo. C., Garwood, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York.

RUBBER TIRES. **(See Tires.)**

RULES

*Lufkin Rule Co., Saginaw, Mich.

SAFETY TREADS. **(See Treads, Safety)**

SASH, ROLLER STEEL. **(See Window Frames and Sash)**

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*Amer. Saw Mill Mach. Co., Hackettstown, N. J.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
Knickerbocker Co., Jackson, Mich.
Leach Co., Oshkosh, Wis.

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*Austin Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Mach. Co., Kennett Square, Pa.
*Huber Mfg. Co., Marion, O.
*Kinney Mfg. Co., Boston, Mass.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Spears-Wells Machy. Co., Oakland, Cal.
*Stockland Road Mach. Co., Minneapolis, Minn.
*Universal Road Machinery Co., Kingston, N. Y.
Acme Road Mach. Co., Frankfort, N. Y.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Mach. Co., J. I., Racine, Wis.
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. Dak.
Lyle Cul. & Rd. Equip. Co., Minneapolis, Minn.

SCARIFIERS, TEETH FOR

*Shunk Mfg. Co., Bucyrus, Ohio.

SCOOPS

*Oliver Ames & Sons Corp., North Easton, Mass.
*Ames Shovel & Tool Co., Boston, Mass.
*Geo. Griffiths Co., Cheltenham, Pa.
*The H. M. Myers Co., Beaver Falls, Pa.
*T. Rowland's Sons, Inc., Cheltenham, Pa.
*St. Louis Shovel Co. Plant, St. Louis, Mo.
*Wright Shovel Co., Anderson, Ind.

SCRAPERS, DRAGLINE

*Sauerman Bros., Chicago, Ill.

SCRAPERS, POWER DRAG

*L. P. Green, Chicago, Ill.
*Sauerman Bros., Chicago, Ill.

SCRAPERS, ROAD **(See Road Scrapers)**

SCRAPERS, SELF-LOADING

*Baker Mfg. Co., Springfield, Ill.
Smith & Sons Mfg. Co., Kansas City, Mo.

SCREENS, SAND, GRAVEL AND COAL

*Atlas Eng. Co., Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*L. P. Green, Chicago, Ill.
*Haiss Mfg. Co., New York.
*Littleford Bros., Cincinnati, O.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Universal Road Machinery Co., Kingston, N. Y.
*Wickwire Spencer Steel Corp., New York.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., Cleveland, O.
Case Threshing Machine Co., J. I., Racine, Wis.
Chain Belt Co., Milwaukee, Wis.
Galion Iron Wks. & Mfg. Co., Galion, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Newaygo Eng. Co., Newaygo, Mich.
New Jersey Wire Cloth Co., Trenton, N. J.
Robins Conv. Belt Co., New York.
Sackett Screen & Chute Co., H. B., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

SCREENS, SEWAGE

Chain Belt Co, Milwaukee, Wis.
Green Bay Fdry. & Mach Wks., Green Bay, Wis.
Link-Belt Co., Philadelphia, Pa.
Sanitation Corp'n, New York.
Simplex Ejector Co., Chicago, Ill.

SEWAGE DISPOSAL APPARATUS

Direct Oxidation Disposal Corp., Phila., Pa.
Dorr Co., New York.
Pacific Flush Tank Co., Chicago, Ill.
Sanitation Corp'n, New York.
Simplex Ejector Co., Chicago, Ill.

SEWAGE PUMPS **(See "Pumps, Centrifugal")**

SEWAGE EJECTORS

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Sanitation Corp'n, New Yorrk.
Simplex Ejector Co., Chicago, Ill.
Ycomans Bros. Co., Chicago, Ill.

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Cannelton Sewer Pipe Co., Cannelton, Ind.
Denver Sewer Pipe & Clay Co., Denver, Col.
Evens & Howard Fire Brick Co., St. Louis, Mo.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Laclede Christy Clay Products Co., St. Louis, Mo.
Macomb Sewer Pipe Wks., Macomb, Ill.
Pacific Clay Products Co., Los Angeles, Cal.
Red Wing Sewer Pipe Co., Red Wing, Minn.
Robinson Clay Products Co., Akron, O.
Standard Fire Brick & Sewer Pipe Co., Pueblo, Col.

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Self Propelling Nozzle Co., New York.
Turbine Sewer Machine Co., Milwaukee, Wis.

SEWER PIPE AND DRAIN TILE

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Blackner & Post Pipe Co., St. Louis, Mo.
Dee Co., Wm. E., Chicago, Ill.
Delaware Clay Products Co., Pittsburgh, Pa.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Denver Sewer Pipe & Clay Co., Denver, Col.
National Fireproofing Co., Pittsburgh, Pa.
Ohio Vitrified Pipe Co., Uhrichsville, O.
Robinson Clay Products Co., Akron, O.

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Champion Corporation, Hammond, Ind.
P. J. Healy, New York.
Turbine Sewer Machine Co., Milwaukee, Wis.

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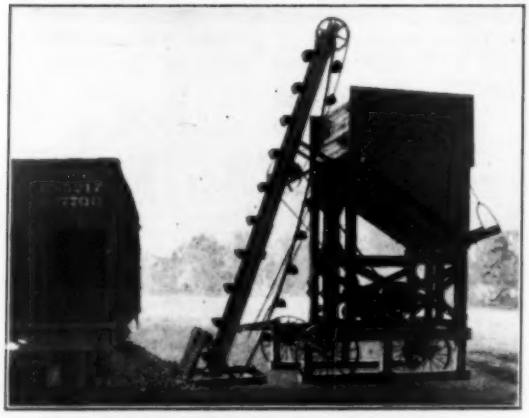
Canton Art Metal Co., Canton, Ohio.
Edwards Mfg. Co., Cincinnati, Ohio.
Eller Mfg. Co., Canton, Ohio.
Milwaukee Corrugating Co., Milwaukee, Wis.
Nat'l Sheet Metal Roofing Co., Jersey City, N. J.
Newport Rolling Mill Co., Newport, Ky.
Penn Metal Co., Boston, Mass.
Klauer Mfg. Co., Dubuque, Ia.



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Hercules Engines always generate the full rated horse power for they are all tested under a continuous pulling load. And they have the minimum of wearing parts. You'll have no breakdowns to hold up your work.

Even in a cloudburst the Hercules stays on the job. The surefire Wico Magneto provides a never failing spark under the worst conditions. A Wico equipped Hercules chugs along with never a miss as long as the gas and oil last.

Hercules Engines are backed by a nation wide organization that insures you prompt and efficient service. There are 350,000 of them doing satisfactory work throughout the country so you'll find a Hercules dealer nearby.

THE HERCULES CORPORATION

Engine Dept. B **Evansville, Ind.**

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Wheeling Metal Mfg. Co., Wheeling, W. Va.

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Symonds Clamp & Mfg. Co., Chicago, Ill.
Universal Form Clamp Co., Chicago, Ill.

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Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Thew Shovel Co., Lorain, O.

SHOVELS, GASOLINE
*Bay City Dredge Works, Bay City, Mich.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Muskegon, Mich.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Thew Shovel Co., Lorain, O.

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*Ames Shovel & Tool Co., Boston, Mass.
*Geo. Griffiths Co., Cheltenham, Pa.
*The H. M. Myers Co., Beaver Falls, Pa.
*T. Rowland's Sons, Inc., Cheltenham, Pa.
*St. Louis Shovel Co. Plant, St. Louis, Mo.
*Wright Shovel Co., Anderson, Ind.
Beall Bros. Co., Alton, Ill.
Connesut Shovel Co., Conneaut, O.
Hubbard & Co., Pittsburgh, Pa.
Indiana Shovel Co., New Castle, Ind.
Jackson Shovel Co., Montpelier, Ind.
Pittsburgh Shovel Co., Pittsburgh, Pa.
Russell Shovel Co., Aliquippa, Pa.
Stevens-Webb Co., Inc., Altoona, Pa.
Union Furnace Mfg. Co., Altoona, Pa.
Wood Shovel & Tool Co., Piqua, Ohio.
Wyoming Shovel Works, Wyoming, Pa.

SHOVELS, STEAM
*Keystone Driller Co., Beaver Falls, Pa.
*Osgood Co., The, Marion, O.
Austin Machinery Corp'n, Muskegon, Mich.
Bellwood Steam Shovel Co., Bellwood, Pa.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., J. F., Ravenna, Ohio.
Erie Steam Shovel Co., Erie, Pa.
Fairbanks Steam Shovel Co., Marion, O.
Industrial Works, Bay City, Mich.
Marion Steam Shovel Co., Marion, O.
Orton & Steinbrenner Co., Chicago, Ill.
Thew Shovel Co., Lorain, O.

SIGNS, STREET AND ROAD
Automatic Signal & Sign Co., Chicago, Ill.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Century Sign Co., Boston, Mass.
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
Lyle-Signs, Minneapolis, Minn.
Municipal Street Sign Co., New York.
Nelke Sign Co., J. L., New York.
Safety Traffic Guide Co., Elkhart, Ind.
Union Iron Products Co., East Chicago, Ind.
Western Display & Mfg. Co., St. Paul, Minn.

SIGNS, TRAFFIC
Adams & Westlake, Chicago, Ill.
Automatic Signal & Sign Co., Chicago, Ill.
American Gas Accumulator Co., Elizabeth, N. J.
Best Traffic Light Co., E. Peoria, Ill.
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Esaco Mfg. Co., Peoria, Ill.
General Electric Co., Schenectady, N. Y.
Griswold Safety Signal Co., Minneapolis, Minn.
Klug & Smith Co., Milwaukee, Wis.
Lebanon Machine Co., Lebanon, N. H.
Line Material Co., So. Milwaukee, Wis.
Little Giant Co., Mankato, Minn.
Lyle-Signs, Minneapolis, Minn.
Ohio Traffic Devices Co., Columbus, O.
Safety Traffic Guide Co., Elkhart, Ind.
Traffic Sign & Signal Co., Gloucester, Mass.
Traffic Signal Corp., New York.
Union Iron Products Co., E. Chicago, Ind.

SLATE, ROOFING
Vendor Slate Co., Inc., Easton, Pa.

SLATE, STRUCTURAL
Keenan Structural Slate Co., Bangor, Pa.
Penna. Structural Slate Co., Easton, Pa.
Phoenix Slate Co., Windgap, Pa.
Structural Slate Co., Pen Argyl, Pa.

SLEEVES, TAPPING AND VALVE
Mueller Company, Decatur, Ill.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.

SLUICE GATES. (See Gates, Sluice)

SMOKE STACKS. (See Stacks, Steel)

SNOW CLEANING MACHINERY
*Austin-Western Road Machy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Good Roads Mach. Co., Kennett Square, Pa.
*Holt Mfg. Co., Peoria, Ill.
*International Motor Co., New York.
*Monarch Tractors, Inc., Watertown, Wis.
Avery Co., Peoria, Ill.
Barber-Greene Co., Aurora, Ill.
Cleveland Tractor Co., Cleveland, Ohio.
Toy Co., W. M., Sidney, Ohio.
Union Iron Wks., Inc., Bangor, Me.
Owensboro Ditcher & Grader Co., Owensboro, Ky.

SPADES (See Shovels)

SPRAYERS, ASPHALT AND TAR
*Kinney Mfg. Co., Boston, Mass.

SPRAYING MACHINERY FOR TREES
Bean Spray Pump Co., Lansing, Mich.
Deming Co., The, Salem, Ohio.
Field Force Pump Co., Elmira, N. Y.
Fitzhenry-Guptill Co., East Cambridge, Mass.

SPREADERS, STONE
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.

STACKS, STEEL
*Blaw-Knox Co., Pittsburgh, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Heil Co., The, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Birmingham Tank Co., Birmingham, Ala.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Honhorst Co., Jos., Cincinnati, O.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STANDPIPES, TANKS AND TOWERS
*Connery & Co., Inc., Philadelphia, Pa.
Caldwell Co., W. E., Louisville, Ky.
Chattanooga Blr. & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Lancaster Iron Wks., Lancaster, Pa.
Pacific Tank & Pipe Co., San Francisco, Cal.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
United Iron Works, Inc., Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM SHOVELS. (See Shovels, Steam)

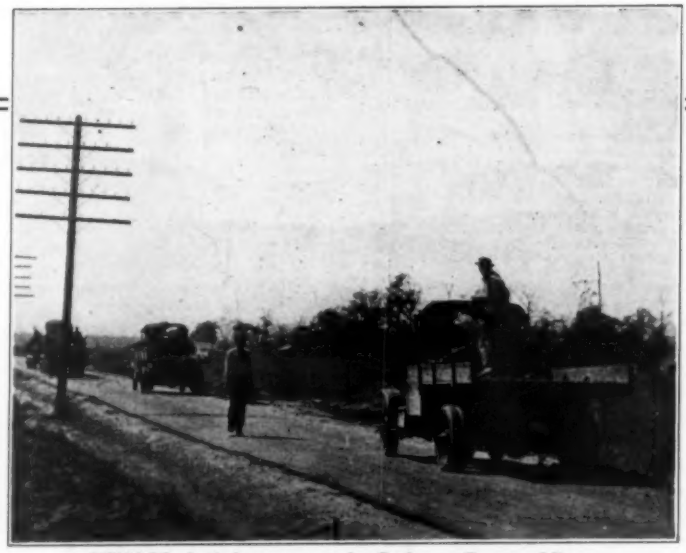
STEAM TURBINES. (See Turbines.)

STEEL PLATE CONSTRUCTION
*Blaw-Knox Co., Pittsburgh, Pa.
*Connery & Co., Philadelphia, Pa.
*Heil Co., The, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Bethlehem Steel Co., Bethlehem, Pa.
Biggs Boiler Wks., Akron, O.
Birmingham Tank Co., Birmingham, Ala.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Graver Corporation, E. Chicago, Ind.
Heltzel Steel Form & Iron Co., Warren, O.
Hendrick Mfg. Co., Carbondale, Pa.
Honhorst Co., Jos., Cincinnati, Ohio.
McClintic-Marshall Co., Pittsburgh, Pa.
Pennsylvania Bridge Co., Beaver Falls, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Pittsburgh, Pa.
Toledo Crane Co., Toledo, O.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Jersey City, N. J.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STOKERS, MECHANICAL
Automatic Furnace Co., Dayton, Ohio.
Babcock & Wilcox Co., New York.
Combustion Engine Corp., New York.
Detroit Stoker Co., Detroit, Mich.
Laclede-Christy Clay Prod. Co., St. Louis, Mo.
Sanford Riley Stoker Co., Worcester, Mass.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

STREET AND ROAD SIGNS. (See Signs, Street and Road.)

** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



TEXACO Asphalt pavement in Coahoma County, Miss.,
Constructed April, 1920

This pavement gets no vacation though it earns one.

Two things are needed to make a satisfactory pavement for this kind of traffic: first, a contractor who knows his business, and secondly, high grade materials.

The road passes through a rich Mississippi farm district, and must carry many tons of farm produce annually.

The pavement is of TEXACO ASPHALT, similar to those which have been constructed in more than 1,000 American cities and towns and upon hundreds of miles of State and county highways.

Learn more about TEXACO Asphalt from TEXACO booklets.

TEXACO

THE TEXAS COMPANY, U.S.A.

Asphalt Sales Department

17 Battery Place, New York City

New York
Philadelphia
Richmond

Boston
Jacksonville
New Orleans

Chicago
Cleveland

Oklahoma City
Kansas City
Houston

Dallas
Minneapolis
St. Louis

STREET CLEANERS' CARTS
Durlach Can & Iron Works, Brooklyn, N. Y.
Rochester Can Co., Rochester, N. Y.
Tarrant Mfg. Co., Saratoga Springs, N. Y.

STREET FLUSHERS AND SPRINKLERS
*Austin-Western Road Machy. Co., Chicago, Ill.
*General Motors Truck Co., Pontiac, Mich.
*Heil Co., The, Milwaukee, Wis.
*Kinney Mfg. Co., Boston, Mass.
*International Motor Co., New York.
Autocar Co., Ardmore, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Federal Motor Truck Co., Detroit, Mich.
Municipal Supply Co., South Bend, Ind.
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Tiffin Wagon Co., Tiffin, O.
White Co., Cleveland, O.

STREET LAMP POSTS
Clow & Sons, J. B., Chicago, Ill.
Drake Mfg. Co., Friendship, N. Y.
Electric Railway Equipment Co., Cincinnati, O.
General Electric Co., Schenectady, N. Y.
King Mfg. Co., Chicago, Ill.
Massey Concrete Products Co., Chicago, Ill.
Mott Iron Wks., J. L., New York.
Union Metal Mfg. Co., Canton, O.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

STREET SIGNS (See Signs, Street)

STREET SWEEPERS
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Mach. Co., Kennett Square, Pa.
*Universal Road Machinery Co., Kingston, N. Y.
Butler Mfg. Co., Cleveland, O.
Elgin Sales Corp'n, New York.
Foamite-Childs Corp., Utica, N. Y.
Springfield Motor Sweeper Co., Springfield, O.

STREET SWEEPING BROOMS
*Littleford Bros., Cincinnati, O.
Holcomb Mfg. Co., J. I., Indianapolis, Ind.
Ind. Brush & Broom Mfg. Co., Indianapolis, Ind.
Kendallville Broom & Brush Co., Kendallville, Ind.
Lang Broom Co., Pittsburgh, Pa.
Lay Co., Jos., Ridgeville, Ind.
Milwaukee Brush Mfg. Co., Milwaukee, Wis.
Osborn Mfg. Co., Cleveland, Ohio.

STREET SWEEPING BROOMS REFILLED
Kendallville Broom & Brush Co., Kendallville, Ind.
Lang Broom Co., Pittsburgh, Pa.
Osborn Mfg. Co., Cleveland, Ohio.

STRUCTURAL STEEL AND IRON. (See Bridges

STUMP PULLERS
Clyde Iron Wks. Sales Co., Duluth, Minn.
Bennett & Co., H. L., Westerville, O.
La Plant-Choate Mfg. Co., Cedar Rapids, Ia.
Thomas Elevator Co., Chicago, Ill.

SUBGRADING MACHINES
The Hug Co., Highland, Ill.

SUPERHEATERS
Babcock & Wilcox Co., New York.
Power Specialty Co., New York.
Superheater Co., New York.

SURVEYORS' INSTRUMENTS. (See Instruments.)

SWITCHBOARDS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

TABLES AND BOARDS, DRAWING. (See Drawing Materials.)

TAMPING MACHINES
*Pawling & Harnischfeger Co., Milwaukee, Wis.
Ingersoll-Rand Co., New York.

TANKS, AIR COMPRESSOR
*Connery & Co., Inc., Philadelphia, Pa.
*Curtis Pneumatic Mchy. Co., St. Louis, Mo.
*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Abendroth & Root Mfg. Co., New York.
Biggs Boiler Wks., Akron, O.
Birmingham Tank Co., Birmingham, Ala.
Chicago Bridge & Iron Works, Chicago, Ill.
Chicago Pneumatic Tool Co., New York.
Graver Corporation, E. Chicago, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Lancaster Iron Wks., Lancaster, Pa.
National Tube Co., Pittsburgh, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.
Westinghouse Tract. Brake Co., Wilmerding, Pa.
Worthington Pump & Machy. Corp., New York.

TANKS, STEEL
*Connery & Co., Philadelphia, Pa.
*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Avery Co., Peoria, Ill.
Biggs Boiler Wks., Akron, O.
Birmingham Tank Co., Birmingham, Ala.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Case Threshing Mach. Co., J. I., Racine, Wis.
Caldwell Co., W. E., Louisville, Ky.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Dover Boiler Wks., New York.
Farrell Mfg. Co., Joliet, Ill.
Fouts Co., C. C., Middletown, O.
Graver Corporation, E. Chicago, Ind.
Hardesty Mfg. Co., R., Denver, Col.
Hendrick Mfg. Co., Carbondale, Pa.
Honhorst Co., Jos., Cincinnati, Ohio.
Lancaster Iron Works, Lancaster, Pa.
Pacific Tank & Pipe Co., San Francisco, Cal.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Inc., Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

TANKS, WOOD
Caldwell Co., W. E., Louisville, Ky.
Davis & Son, G. M., Palatka, Fla.
Eagle Tank Co., Chicago, Ill.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
National Tank & Pipe Co., Portland, Ore.
Pacific Tank & Pipe Co., San Francisco, Cal.
Redwood Manufacturers Co., San Francisco, Calif
Stearns Lumber Co., A. T., Boston, Mass.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Wendnagel & Co., Chicago, Ill.

TANK WAGONS
*Acme Road Mach. Co., Frankfort, N. Y.
*Heil Co., Milwaukee, Wis.
*International Motor Co., New York.
Avery Co., Peoria, Ill.
Birmingham Tank Co., Birmingham, Ala.
Butler Mfg. Co., Minneapolis, Minn.
Case Threshing Mach. Co., J. I., Racine, Wis.

TAPES, STEEL AND METALLIC
*Lufkin Rule Co., Saginaw, Mich.
Dietzgen Co., Eugene, New York.
Keuffel & Esser Co., Hoboken, N. J.
Starrett, L. S., Athol, Mass.

TAPPING MACHINES
Hays Mfg. Co., Erie, Pa.
Mueller Co., Decatur, Ill.
Smith Mfg. Co., A. P., E. Orange, N. J.

TAR
*Barrett Co., New York.
American Tar Products Co., Chicago, Ill.

TAR KETTLES. (See Kettles)

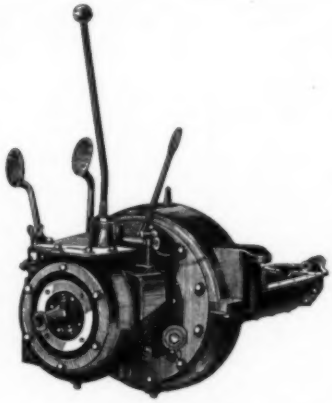
TIES, STEEL
*Koppel Ind. Car & Equip. Co., Koppel, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Sweet's Steel Co., Williamsport, Pa.

TIMBER CLAMPS
Pyle-Rogers Corp., New York.

TIRES, RUBBER. (For Motor Trucks.)
*Goodrich Rubber Co., Akron, O.
Firestone Tire & Rubber Co., Akron, O.
Fisk Tire Co., Chicopee Falls, Mass.
Goodyear Tire & Rubber Co., Akron, O.

The Ford Motor Co. Says

"The installation of transmissions that necessitate cutting off the drive shafts and radius rods, and removing the running board bracket braces, SHOULD NOT BE MADE, unless some method of supporting the additional weight is provided." Letter No. 238 to Authorized Dealers, Detroit, Sept. 12, 1924.



SO YOU HAVE HIMICO

Himico Transmissions require no chassis changes to install. Himico weight is supported by a sturdy replacement crankcase that strengthens and stiffens the whole power plant. Himico therefore never breaks crankcase arms or engine legs.

Your Ford trucks often face conditions which only a sliding gear transmission can satisfactorily meet.

Preserve the inherent merits of your Ford chassis by installing Himico—not an attachment but a replacement—that gives all the added PULLING POWER you need, and the added STRENGTH necessary to support it.

As a Transmission or as a Power Plant, Himico installation is simple and requires absolutely no chassis changes. Write for full details.

Transmission, $137; Power Plant (including transmission with remanufactured Engine, built from original Ford parts to which we have added Hot Spot Manifold, High Velocity Head, and Light Pistons) $184; Emergency 42 to 1 fourth Gear, $15; Powerful Takeoff, $18.

HINKLEY MOTORS, INC.

(Builders of famous Hinkley Heavy-Duty Automotive Engines)

P. O. Box E-839 **Detroit, Mich.**

HIMICO

TRANSMISSIONS

POWER PLANTS

Kelly Springfield Tire Co., New York.
Republic Rubber Co., Youngstown, O.
U. S. Tire Co., New York.

TOOL HOUSES, PORTABLE STEEL
*Littleford Bros., Cincinnati, O.

TOWERS. **(See Standpipe, Tanks and Towers)**

TRACKS, INDUSTRIAL AND PORTABLE
*Easton Car & Constr. Co., New York
*Koppel Ind. Car & Equip. Co., Koppel, Pa.
Atlas Car & Mfg. Co., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Fdry. & Mfg. Co., Columbus, O.
Hunt Co, Inc., C. W., West New Brighton, N. Y.
Lakewood Engineering Co., Cleveland, O.
Sweet's Steel Co., Williamsport, Pa.

TRACTORS
*Best Tractor Co., C. L., San Leandro, Cal.
*Ford Motor Co., Detroit, Mich.
*Holt Mfg. Co., Peoria, Ill.
*Huber Mfg. Co., Marion, O.
*International Motor Co., New York.
Advance-Rumeley Thresher Co., Laporte, Ind.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Avery Co., Peoria, Ill.
Bates Machine & Tractor Co., Joliet, Ill.
Bear Tractors, Inc., New York
Case Threshing Machine Co., J. I., Racine, Wis.
Clark Tructractor Co., Chicago, Ill.
Cleveland Tractor Co., Cleveland, O.
Emerson-Brantingham, Rockford, Ill.
Hart-Parr Co., Charles City, Iowa.
International Harvester Co., Chicago, Ill.
J. T. Tractor Co., Cleveland, O.
Kinnard & Haines, Minneapolis, Minn.
John Lauson Co., New Holstein, Wis.
The Minneapolis Line, Minneapolis, Minn.
Monarch Tractors, Inc., Watertown, Wis.
Shaw-Enochs Tractor Co., Minneapolis, Minn.
Tioga Tractor Co., Baltimore, Md.
Toro Mfg. Co., Minneapolis, Minn.
Twin City Co., Minneapolis, Minn.

TRAFFIC LINE MARKERS
Hampden Supply Co., Springfield, Mass.
Highway Appliance Co., Inc., Providence, R. I.
Line-O-Graph Co., New York.
Spray Painting & Finishing Equip. Sales Co., Boston, Mass.

TRAFFIC PAINT
Hoosier Paint Wks., Ft. Wayne, Ind.
Sewall Paint & Glass Co., Kansas City, Mo.
Tropical Paint & Oil Co., Cleveland, Ohio.
Truscon Laboratories, Detroit, Mich.

TRAFFIC SIGNS. **(See "Signs, Traffic")**

TRAILERS FOR TRUCKS AND TRACTORS
Arcadia Trailer Corp., Newark, N. Y.
Eagle Wagon Works, Auburn, N. Y.
Highway Trailer Co., Edgerton, Wis.
La Plant-Choate Mfg. Co., Cedar Rapids, Ia.
Lee Trailer & Body Co., Chicago, Ill.
Miami Trailer-Scraper Co., Troy, Ohio.
Troy Wagon Works, Troy, O.
Warner Mfg. Co., Beloit, Wis.
Watson Products Corp'n, Canastota, N. Y.
Whitehead & Kales Co., Detroit, Mich.

TRAILERS, INDUSTRIAL
Chase Fdry. & Mfg. Co., Columbus, O.
Electric Wheel Co., Quincy, Ill.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.

TRAMWAYS, AERIAL WIRE ROPE
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.

TRANSFORMERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Duncan Elec. Mfg. Co., Lafayette, Ind.
Enterprise Electric Co., Warren, Ohio.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Maloney Electric Co., St. Louis, Mo.
Packard Electric Co., Warren, Ohio.
Pittsburgh Transformer Co., Pittsburgh, Pa.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

TRANSITS AND LEVELS. **(See Instruments.)**

TRANSMISSION. **(Auxiliary for Ford Trucks.)**
*Warford Corpn., New York.

TRANSMISSION MACHINERY, POWER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Corp'n, Mishawaka, Ind.
General Electric Co., Schenectady, N. Y.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

TRASH CANS. **(See Cans)**

TREADS, SAFETY
American Abrasive Metals Co., New York
American Mason Safety Tread Co., Lowell, Mass.
Concrete Steel Co., New York.
Norton Co., Worcester, Mass.

TRENCH PUMPS. **(See Pumps, Contractors')**

TRENCH EXCAVATORS, **(See Excavators Ditch & Trench)**

TRENCH PUMPS. **(See Pumps, Contractors')**

TURBINES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
De Laval Steam Turbine Co., Trenton, N. J.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.
Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa

TURNTABLES FOR MOTOR TRUCKS
*Blaw-Knox Co., Pittsburgh, Pa.
Champion Eng. Co., Kenton, O.
Easton Car & Const'n Co., Easton, Pa.
Freeman Mfg. Co., Racine, Wis.
The Hug Co., Highland, Ill.
Western Structural Co., Moline, Ill.

VALVE CONTROL APPARATUS, ELECTRIC
Payne Dean, Ltd., New York.

VALVES, CHECK
*Ludlow Valve Mfg. Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Michigan Valve & Fdry. Co., Detroit, Mich.
Rensselaer Valve Co., Troy, N. Y.

VALVES, GATE AND INDICATOR POSTS
*Ludlow Valve Mfg. Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Columbian Iron Wks., Chattanooga, Tenn.
Crane Company, Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

VALVES, TAPPING & SLEEVES **(See "Sleeves")**

VALVE BOXES AND HOUSINGS
*Central Foundry Co., New York.
*Ludlow Valve Mfg. Co., Troy, N. Y.
*U. S. C. Ir. Pipe & Fdry. Co., Burlington, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Mueller Mfg. Co., H., Decatur, Ill.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

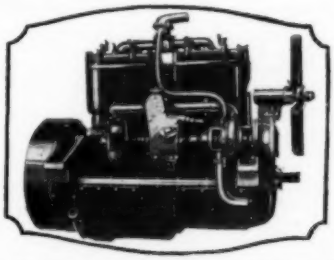
VENTILATORS
American Blower Co., Detroit, Mich.
Edwards Mfg. Co., Cincinnati, O.
Milwaukee Corrugating Co., Milwaukee, Wis.

WAGONS. **(See Dump Carts and Wagons.)**

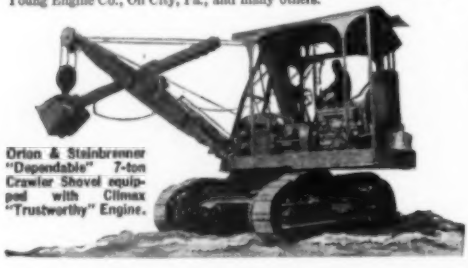
WAGON BODIES. **(See Dump Bodies.)**

WAGON LOADERS. **(See Loaders, Gravel and Wagon)**

Getting the BEST out of Machines and Men



Climax "Trustworthy" Engines are used as Standard Equipment by—Bay City Dredge Works, Bay City, Mich., Byers Machine Co., Ravenna, Ohio, Equitable Asphalt Maintenance Co., Kansas City, Mo., Fairbanks Steam Shovel Co., Marion, Ohio, Fate-Root-Heath Co., Plymouth, Ohio, Greiman Ditcher Co., Inc., Garner, Iowa, J. T. Tractor Co., Cleveland, Ohio, Keystone Driller Co., Beaver Falls, Pa., Link-Belt Co., Chicago, Ill., Locomotive Crane Co. of America, Champaign, Ill., McMyler-Interstate Co., Cleveland, Ohio, Mundie Manufacturing Co., Peru, Ill., North-West Engineering Co., Green Bay, Wis., Orton & Steinbrenner Co., Huntington, Ind., Parsons Co., Newton, Iowa, Rix Compressed Air & Drill Co., San Francisco, Calif., Russell Co., Massillon, Ohio, Vulcan Iron Works, Wilkes-Barre, Pa., Geo. D. Whitcomb Co., Rochelle, Ill., W. T. Young Engine Co., Oil City, Pa., and many others.



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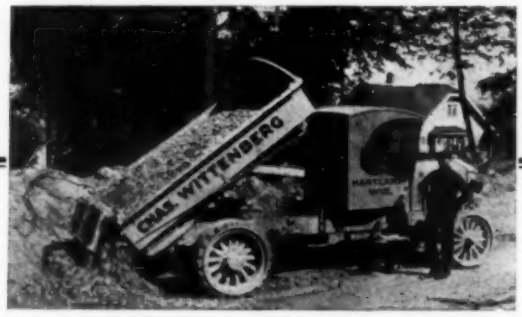

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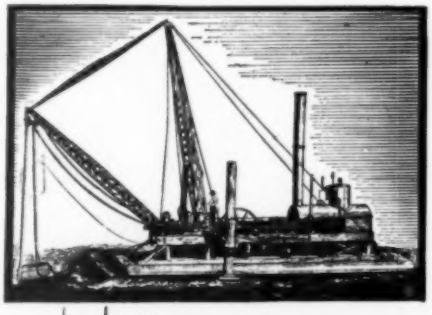

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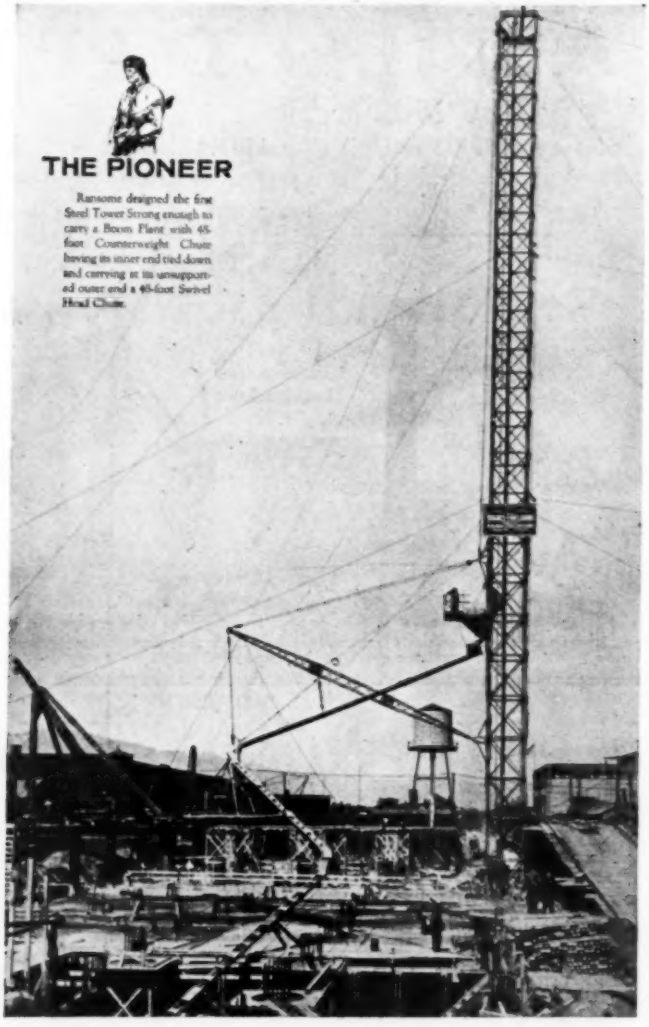
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Proper Plant for Concrete Work

Report of Committee C-I of the American Concrete Institute

Purpose of Report

The purpose of this report is a general statement of the principles on which plant design depends and as thorough an exposition of these principles as is possible to present at this time, this without any restriction as to the type of project under consideration, but to illustrate particular types of concrete plants applicable to a certain set of given conditions. There is no discussion as to the relative merits of any type of equipment as applied to general uses, but rather a consideration of the use to which each particular device may be put so that it will work out to the best advantage.

PLANT design involves not merely the question of equipment but also of men, and the proper combination and coordination of the two. An estimate sheet may refer to materials and labor, but any operation plan which does not consider the human element as being of major importance is faulty. Our problem properly stated is one of materials and men. An effort will be made to show just how these two factors can best be combined to attain the desired results on any concrete structure.

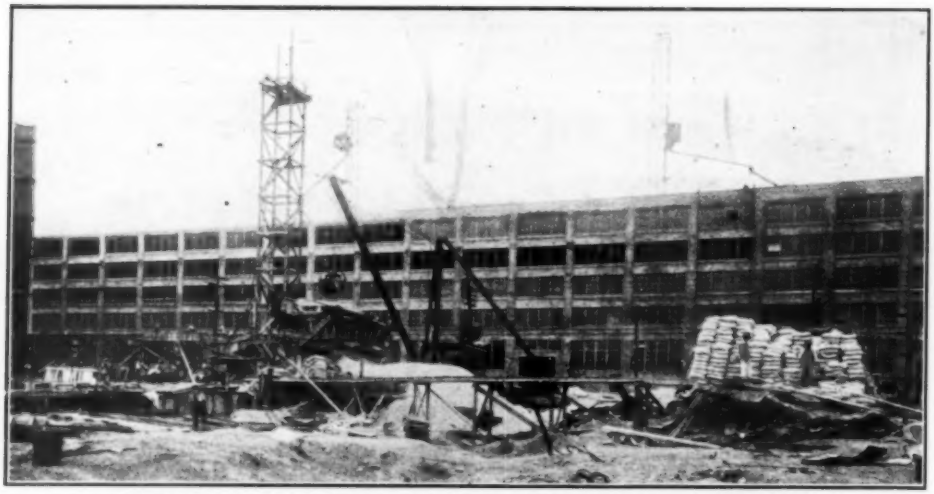
Construction of any sort is essentially a manufacturing proposition, and the elements which enter into the design and layout of machinery in a fixed manufacturing plant are the same as those which enter into the design and layout of a plant for construction purposes—with this difference: plant on a construction job is temporary and the ease of dismantling is to be considered as much as the cost of erection. Just as in the factory we have to take raw materials or their derivatives and change them into the finished product, so on any piece of construction work we are to convert various materials into roads, bridges, dams or buildings of the quality desired and specified with the requisite speed and at a cost which is to be reasonable and just. There may be exceptions to this general rule where political or financial considerations take precedence over those stated, but such jobs are luckily few and far between.

Knowing then these considerations entering into any construction work, it is next necessary to obtain certain preliminary information, and also to carefully weigh various matters having to do with the efficient operation of the plant. We will endeavor to outline all these items and to show the influence exerted by each in making a proper design. We will give illustrations of various plants showing the application of the principles enumerated and conditions which were found at the start of the job and how well they aided in the completion of the project as originally planned and scheduled.

The items entering into such a study have for convenience and reference been outlined in the form of tables. An analysis consists of two distinct steps, which are separated as shown in tables "A" and "B" on pages 49 and 52.

TABLE "A"—INFORMATION DESIRED

1.	Quantity materials needed—general	Steel; Lumber, brick and tile; Cement; Sand and gravel
2.	Source raw materials or derivatives	
3.	Location of these materials in finished structure	
4.	Methods of transportation available	
5.	Methods of handling that are available	
6.	Space available—storage	Traffic conditions; Weather conditions; Labor conditions
7.	Power available	
8.	Layout of ground	
9.	Probable weather conditions	
10.	Probable labor conditions	
11.	Special consideration	Sequence of work; Relation to other work; Finished floors; Size sections



BUILDING THE R. H. MACY WAREHOUSE, LONG ISLAND CITY, NEW YORK

On this plant a ¾-yard clam-shell bucket was used to charge a 25-yard bin directly over the 1-yard Koehring mixer, which discharged into a 1-yard Lakewood bucket on a wood tower. The concrete was distributed in buggies. The operation involved the placing of about 6,000 yards of concrete and was completed in record time

Table "A"—Information desired, and
Table "B"—The various points to be considered in detail before making final decision on plant, with the various subheadings under each of these major subdivisions as shown in the outline:

A. As previously outlined, the first step involved in design of plant is to obtain necessary information either from the engineer and owner, from plans or from a survey of the property and surroundings as they exist previous to the start of the proposed improvement.

1. The first information necessary is the quantity and grade of each material entering into the finished project and in general consists of steel, lumber, cement, sand, gravel or stone, brick and tile. The quantities are necessary in order to determine how much storage space is necessary, the relative importance of each to the job, and also in order to determine whether large or small scale production methods may be used—in other words, how much may be economically expended on plant to save a certain amount per unit of material in handling. It is necessary to know the quality of material to be used so that methods of handling may be devised which will not be detrimental.

2. The second item of information necessary is the source of raw materials or their derivatives. In being changed from their natural state to their condition in the finished work, materials may undergo several operations. Whether these operations are performed by the builder or by the dealers previously handling the material depends largely on the size of the job and its accessibility. For instance, the savings on a large job, difficult of access and convenient to materials in their natural state, would pay for the installation of machinery necessary to carry out the operations necessary to make all the transformations. On the other hand, a small job located centrally in a town would only justify the buying of materials in as nearly a finished state as possible from the nearest dealer. Between these two extremes lie many cases where a compromise must be made, the nature of which depends entirely on a close study of each individual case.

3. It is necessary to know the location of all the materials in the finished structure. We may then lay out the plant and attendant storage so that each operation involving motion, places material more convenient for its final incorporation into the finished job. In this way handling may be done more easily and economically and also storage space may be conserved by placing all materials so that they will not interfere with the movement of other materials which must reach their place in the structure at an earlier date.

4. Closely allied to the points previously given are the methods of transportation available in any given section. It is necessary, for instance, to know whether freight cars, auto trucks, scows or other means are available, whether the job justifies it, and if not, what other arrangement can be made by which material will be moved another step nearer its final place.

5. With methods of transportation also goes the mechanical means available for handling material, as it is useless to consider transportation methods without considering also how materials are to be loaded and unloaded. Naturally, on small jobs mechanical methods of handling cannot be considered except in certain special cases where someone else may have equipment installed which would otherwise be idle, and will perform the service quite cheaply on that account.

6. No decision on methods of handling materials can be properly made without a survey of the site and surrounding features. A study of contours and occurrence of water is of special importance, as the slope of the ground may, to a considerable extent, determine the design of the plant, since all grades should be used to advantage. Water must be particularly considered

where a tunnel or a mixer and tower pit is planned on, and means must be devised to overcome this handicap with as little expense as possible, both in installation and operation. The extent of available storage space often determines methods, since it will determine the size of lots in which material may be received.

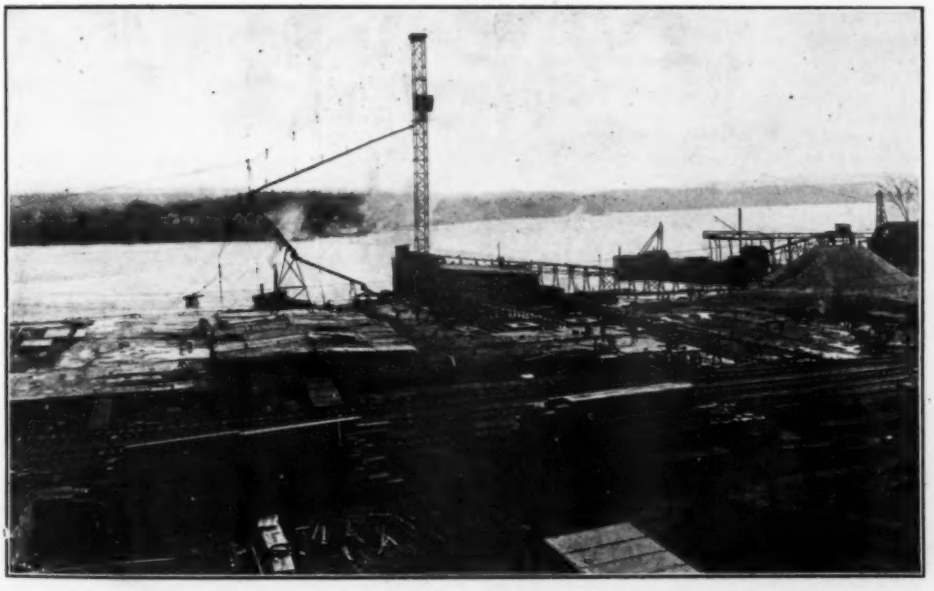
7. Power, if available near the site, must be carefully investigated and all conditions applying thereto looked into to determine source for use on the job. Local rules of power companies as to types of motors to be used, etc., may often cause rejection of the most apparent source. Water also should be looked up at the same time.

8. In case the builder is not familiar with the district where the construction is to take place, it will be necessary to study the probable weather conditions during the course of the job. Where a job is to go ahead during the winter when cold and bad weather is probable, the plant should be laid out so as to take advantage of every day not of extreme severity. This may be done by compacting the layout so protection is afforded to practically all the men required to operate. A balance must be struck here, however, between the inefficiency of the workmen under these conditions and the cost of a shut-down with attendant loss on overhead and lengthening of the job. Plants should also be designed larger for winter work than in summer in order to keep nearer to summer speed by accomplishing more on the fewer good days.

9. Probable labor conditions during the course of the job must also be looked up. With low-priced labor of the pick and shovel variety, less money may be spent on plant. If, however, labor is scarce and therefore high-priced and independent, plant must be designed to eliminate all hard work and also as many men as possible. The attitude taken by various labor men in some sections may also influence a decision on certain types of equipment.

10. Special considerations may be called for by plants and specifications in some jobs or may be desirable due to requirements of the architect, engineer or other interested party. Sequence of work may be required, relation to other work may be specified, or structural conditions may be such as to materially affect plant, particularly as to capacity. As an example, a specification calling for grit in monolithic finish floors demands a larger plant and an arrangement for handling and storing this material convenient to mixer. A large plant is then also required so that concrete may be completed earlier, finish put down and excessive overtime avoided on troweling. Size of concrete structural sections determines size of aggregate that may be used and, therefore, to a certain extent the size and design of plant. Small sections cannot be poured as rapidly as larger, therefore a smaller plant may be installed.

The second study is summarized in Table "B" following, with the various subheadings and the successive steps in analysis as follows:



CONSTRUCTION VIEW OF THE ROBERT GAIR COMPANY'S PLANT AT MONTVILLE, CONN.

A very large one-story reinforced concrete platform was built, on which a two-story steel structure housing the new paper mill was erected. The mixing plant is located on an old car float sunk in the river, thoroughly braced, with the steel tower and mixer erected on it. The sand and gravel barges were unloaded at the extreme right, brought in shore several hundred feet to a general storage pile, from the bottom of which a belt conveyor brought the material to a bin over the mixer. Cement was brought from the railroad tracks in the foreground on a rolling conveyor to the mixing plant. The entire contract of about $300,000 was completed during the winter

TABLE "B"—POINTS TO BE CONSIDERED IN DETAIL BEFORE MAKING FINAL DECISION ON PLANT

1. Costs of various installations
   - Rental
     - First cost
     - Salvage, interest
   - Operation
   - Installation and removal
   - Maintenance
2. Reserve supply
   - Weather
   - Labor
   - Traffic conditions
   - Convenience heating
3. Convenience in weather protection
   - Cold
   - Rain
4. Few bottleneck equipments to avoid congestion or to replace in case of breakdown
5. Accessibility for repairs
6. Coordination balancing all facilities
7. Uniformity of mix
8. Proportioning
9. Location so as to reach all parts of work with all materials

B. After the special information applying to each particular job has been compiled from various sources, the other considerations which apply to all contracts must be weighed before a definite decision on plant can be made, as follows:

1. The total cost of each possible installation must be balanced against the savings in handling various units of material. This cost consists of rental, installation and removal, maintenance and operation.

2. Reserve supply necessary is determined by weather, labor and traffic conditions, also in some cases by convenience in heating. Enough material should be stored so that any temporary interference in line of communications, whether by traffic, weather or labor conditions, will not cause a job tie-up before adverse conditions can be remedied.

3. Convenience in weather protection of plant, whether from cold or rain, has already been well covered. This study involves a balancing of the cost of a day lost against higher unit costs of working under protection. It is also necessary that materials themselves may be so compactly stored as to be easily protected and heated.

4. By avoidance of bottlenecks is meant a layout such that if any man or appliance cannot function, progress on the job will not be impeded. In case of machinery which by necessity occupies such a critical position on the job as to cause an entire shut-down in case of failure, it is well to inspect frequently, provide spare parts if practicable, ascertain where repairs may be quickly made, and also arrange an alternate so the job may carry on at a higher unit cost temporarily. As to men, it is well to have as few as possible that are absolutely essential to the proper conduct of a job. Should this, however, prove unavoidable, arrangements must be made to train another to serve in an emergency so as not to delay work.

5. All machinery should be so placed that in case of a failure every part is accessible for repairs, or in a smash, that the whole machine can be removed.

6. By coordination is meant the balancing of all facilities for handling materials so that they will all carry on the job at the speed planned on. For example, it is useless to have a mixer and gang capable of turning out twenty yards an hour unless supply and reserve give us that quantity or that twenty yards can be taken away from the machine per hour. Only in case of varying demands being made on a machine or gang should either be larger than the normal. This condition, however, often occurs in the receipt of materials on a job due to supply not being constant. As a rule, plant should be larger than desired rather than run the risk of not being adequate.

7. In order to secure uniformity of mix, it is necessary to start at source of material and so arrange handling that it will not be segregated but rather better mixed than when received. Raveling may be minimized by proper handling.

8. Proper proportioning is more easily attained by careful planning of plant at the start of a job than by any other method. In fact, it is often impracticable later to make a change in handling. By arranging facilities so that space and headroom is left for measuring boxes we can guarantee that mix is being turned out as intended. This may mean a saving in materials; at least the results are known and not approximated.

9. Layout of plant so as to deliver to all parts of the work is particularly desirable in the case of those jobs covering a large area. Both work and layout must be considered so that at every step materials may go forward as desired and no recent work, other material, or interruption in supply interfere.

Conclusions.—We have now reached the point where, having obtained necessary information and having in mind the various points to be considered, we are ready to proceed to the actual design of plant. To do this intelligently it is necessary to trace all materials from source to final place in job, estimate all handling costs, whether these be of material, labor, or the various plant charges, and balance the advantages and cost of each method of handling against those of the other. Some must be approximated from previous experiences, as this is the only source of information. If at all possible, crude methods should be discarded no matter if they show up better, because of effect on the morale and the workmanship, as this is by no means a negligible factor.

Since this is to be a general paper and to apply to all concrete construction, whether of roads, dams, piers, or buildings, it is necessarily couched in general terms. Also, in making the exposition on handling materials we must limit ourselves to the receipt of the material on the job, since we could not consider such a broad scope as would involve quarrying of rock, crushing of stone, etc., although these processes may be carried out on comparatively small jobs. It is assumed, however, that any plant study to be complete must go back further than indicated in this paper.

Material is usually brought on a job by freight or industrial cars, scows, trucks, or, for special cases, on cableways. From the point of receipt there are usually three operations: (1) conveyance to storage; (2) from storage to mixer; and (3) mixer to place of deposit in the structure. The table on page 54 shows relation of each of

these operations to a variety of machinery generally used for this purpose. Each operation may or may not involve the use of both equipment and men. It is highly advantageous to make a close study right here in order to, if possible, omit one or more of these operations on as large a volume of material as possible in order to cut costs. We will recommend various short cuts in operation as we proceed with the discussion.

In receiving by scows or freight cars we are confining ourselves to such cases as are landed close enough to be handled into storage without trucking. Scows and freight cars of aggregate are generally unloaded by grab bucket, although some jobs may be large enough for the use of bottom-dump cars on a trestle. In using a grab bucket, if possible, lay out so that point of receiving and center of bin over mixer is on the same circle of circumference, this to avoid booming of derrick. It is also very often possible to handle materials direct to mixer, thus saving Operation No. 2.

Industrial cars are often used on road jobs and may carry loose aggregate, or batch-boxes to be unloaded by a crane or derrick.

Trucks may carry the batch-boxes or loose aggregate. Those with loose aggregate may be backed upon a planked runway or trestle over a tunnel, which will facilitate the second operation. Contour of ground will often favor this method.

Cableways will handle into storage in a manner similar to grab buckets. Scrapers may sometimes be used to pile aggregate over a tunnel or against a bulkhead.

RECEIVING—OPERATION No. 1 on lumber and steel may involve crane or derrick on large jobs. Cement may be handled by traveling belt conveyor, roller conveyor, derrick, or hand wheeling.

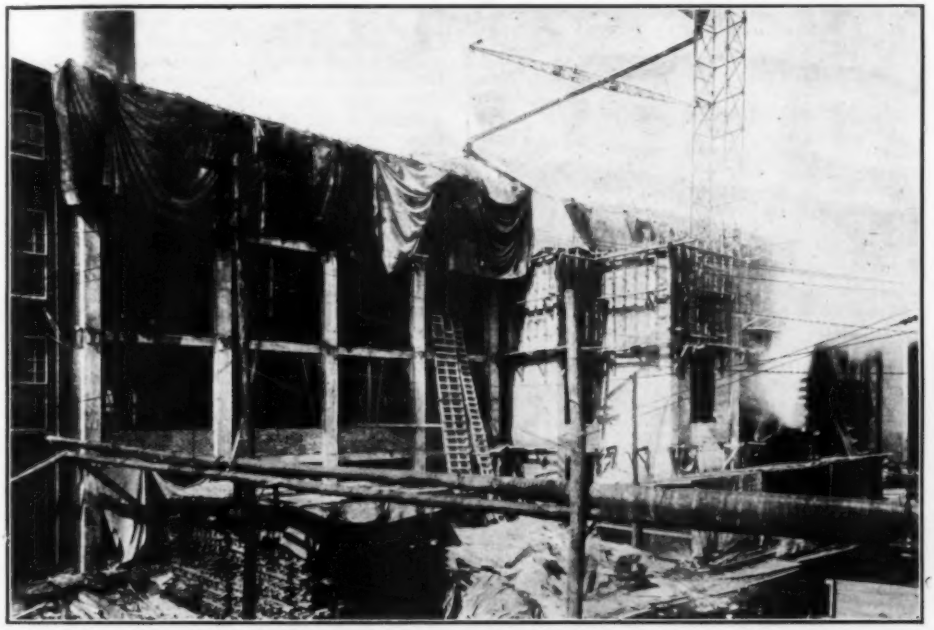
The tryout to be made by one of the railroads of unit containers for handling brick may revolutionize methods by using the same container for a number of brick from kiln to floor where used.

HANDLING—OPERATION No. 2 may be carried out, as far as aggregates are concerned, by industrial cars, particularly in the case of tunnel under storage pile, mentioned under Operation No. 1. A steam shovel or traveling crane may be used where storage covers more ground than may be reached by a stationary derrick. In some cases storage directly over a mixer may be filled by belts or buckets from a boot into which trucks dump; thus eliminating Operation No. 2.

Where conditions are unfavorable to machinery, hand shoveling into barrows or carts may be used. Even here, a close time study is necessary to show which method is preferable. Cement in Operation No. 2 is handled by belts, derricks or by hand, similar to Operation No. 1.

With other materials Operation No. 2 is omitted.

PLACING—OPERATION No. 3, covering the handling of wet concrete from mixer to place, may employ a great variety of mechanical devices,



CONSTRUCTION SCENE, SPINNING MILL OF THE ALEXANDER SMITH COMPANY, YONKERS, N. Y., ERECTED DURING THE COLD WINTER OF 1923

This plant consisted of a ¾-yard Insley chuting system and a ¾-yard Koehring mixer, charged from a 100-cubic-yard bin which was loaded by a bucket conveyor, seen dimly outlined on the right-hand side of the mixer. Both the bin and the mixing water were heated by steam which is seen escaping and slightly obscuring the plant

Material Received in	Equipment Used		
	Operation No. 1 Receiving	Operation No. 2 Handling	Operation No. 3 Handling and Placing
Freight Cars, Industrial Cars, Scows, Trucks, Cableways	Grab Bucket, Crane, Belt Conveyor, Bucket, Scrapers — Storage	Industrial Cars, Trucks, Cableways, Crane, Grab Bucket, Belt Conveyor, Derrick, Bucket, Buggy, Barrow, Scrapers, Steam Shovel — Mixer	Industrial Cars, Trucks, Cableways, Cranes, Derricks, Belt Conveyors, Chutes, Tower (one or more), Buggy, Barrow — To Place

but consists essentially of elevating or lowering and transportation. In larger buildings compactly built, it generally consists of stationary mixer, tower and bucket with chutes or buggies for distribution. In buildings covering a large area or small buildings requiring low plant expenditure it may involve only a small mixer with a pole or tower with bucket, both of which may be movable or stationary. The mixer itself may be mounted on a tower and fed by a skip, the tower being on rollers and readily moved along as the work progresses. Mixer and attendant derrick are sometimes mounted on auto chassis or caterpillars to secure greater mobility.

On large jobs covering a great area there is often a choice to be made between several unit plant installations or having one large central plant distributing concrete to various parts by cars or by chuting from top of one tower to base of another, etc.

In construction of concrete bridges floating equipment on which all three operations may be carried out may be used—the derrick for receiving, mixer with overhead hopper, cement shed with belt, tower and chutes, all on the same barge.

On dams and piers it is possible to use cableways, industrial cars, flat cars in conjunction with derricks and cranes, belts and also towers and chutes.

On roads and pavements the mixer is usually movable, and bucket or chutes are used to convey concrete directly into place.

For materials other than wet concrete, the usual procedure is to so arrange the concrete plant that these materials can be handled with the tower equipment and at the same time, unless the job is of such a size as to require hand handling. Niggerheads on hoists with booms on towers or separate gin poles, traveling derricks, etc., will handle steel or lumber. Brick and tile will be handled by a hod hoist or by a platform in the concrete tower.

In special cases there will be other materials than those mentioned which will require attention in laying out. It is rarely indeed that a plant used on one job can be economically duplicated on another, even though the jobs themselves are similar. A change in anticipated labor or weather conditions may force a material change in plans.

In designing, however, when at a loss to make a decision on the best method of handling it is well many times to come back to the original proposition: material is to go from source to its final place in the work as a geometrical proposition—a straight line is the shortest distance between two points. Modifications are naturally necessary, but these may be made by judging the relative importance of the various materials entering into the structure and decision rendered accordingly.

ACKNOWLEDGMENT.—Printed with permission from the 1924 copyrighted Proceedings of the American Concrete Institute. Illustrations are furnished by the courtesy of John G. Ahlers, Barney-Ahlers Construction Corp., New York City.

"Give Your Truck a Chance"

"GIVE your truck a chance," urges the *Western Canada Contractor*, and points out that the truck represents a considerable investment, and suggests these precautions against rapid depreciation.

Lubricate it regularly and thoroughly.
Refer to lubrication chart daily.
Keep the motor clean.
Do not neglect the valves.

Check them carefully whenever you notice lack of compression. If the valves do not seat perfectly, you cannot get full power, and there will be an increased consumption of gasoline and probably burnt valves and valve-seats.

Do not neglect minor repairs or adjustments.

Carefully examine steering and brake rods daily.
Do not tamper with the governor.

If you do, you cancel the guarantee, and, sooner or later, will get your truck into trouble.

Drain the crank-case at least once a week.
It is economy to use high-grade oil.
Do not race your motor.
Never idle your motor unnecessarily.

It results in excessive carbon, trouble and expense.

Draw up all loose bolts.
Never neglect rattle—fix it at once.

Truck should be inspected every thirty days by a competent mechanic.

Travel slowly over rough roads.
Do not overload.

Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

Waiver of Mechanic's Liens

Said the Connecticut Supreme Court of Errors in the recent case of Townsend vs. Barlow, 124 Atlantic Reporter, 832:

"The term 'waiver of mechanic's lien' has by long usage become descriptive of a writing having the purpose and effect of releasing, according to its terms, the statutory right to a mechanic's lien. Though in terms purporting to affect only the mutual rights of the lienor and owner, it is intended for the information and security of third persons who may be induced thereby to loan money to the owner of the premises on the lienor's assurance that his statutory incumbrance has been released; and the real consideration which moves the lienor to release his incumbrance is the expectation that his employer will be put in funds out of which he hopes to be paid in whole or in part. A waiver of mechanic's lien, having these well-understood implications, and which in terms waives and relinquishes all liens and claims of liens which the lienor now has or hereafter may have, possesses a very plain and unmistakable legal significance."

Bridge Contractor Liable for Accident to Traveler

A contractor who constructed a bridge constituting part of a highway improvement was liable for destruction of an automobile which fell into an excavation produced in building the bridge, according to the view taken by the Kansas Supreme Court in the case of Mundell vs. Board of County Commissioners of Sedgwick County et al., 226 Pacific Reporter, 757. Defendant Amerman, the bridge contractor, disclaimed liability, on the ground that his contract had been fulfilled and that Bechtelheimer, the highway grading contractor, was, by direction of the county engineer, in charge of the premises and responsible for their condition when the accident occurred. Overruling this defense, the Court said:

"The excavation was a detail of construction of the bridge. Backfilling of such an excavation to the original ground surface was made part of the excavation. The contractor engaged to erect barriers, maintain lights, and take all necessary precautions to safeguard the traveling public, and to assume all risk and liability for damages to person or property resulting from negligence of himself, his agents, or servants, and for all damages, direct or indirect, suffered or claimed, on account of construction, until the bridge was completed and accepted. There was no evidence the bridge had been accepted by either the engineer or the board of county commissioners before the accident occurred. The result is it made no difference what Bechtelheimer's grading contract might cover. Amerman could not be discharged from liability until the completed bridge was accepted."

Contractor Entitled to Lost Profits on Justifiably Abandoning Work

In the case of Washburne et al. vs. Property Owners' Cooperative Association of Middlesex County, Inc., 205 New York Supplement, 36, decided by the Appellate Division of the New York Supreme Court, the plaintiffs sued to recover damages for breach of a written contract under which plaintiffs agreed with defendant corporation to lay out and grade certain streets on a tract of land owned by defendant. The suit involved a question of plaintiff's performance of the work called for in the contract, so far as it was performed, whether plaintiff contractors abandoned the contract, or whether defendant owner and his new engineer in charge of the work insisted upon unreasonable changes not called for in the contract, and whether he refused to allow the plaintiffs to go on with the work, except they assented to such unreasonable conditions. The Court said:

"If the owner refused to allow the contractors to proceed under these circumstances, the contractor was not barred from recovering future profits. . . .

"Defendant changed its engineer in charge of the work three times during this period, and the last engineer objected to the original plans and grade provided for in the contract, and to the work performed under his predecessors. Whether his objections were good or bad, he could not so alter the written contract between the owner and the contractor, and there was evidence that the owner refused to allow plaintiffs to proceed with the additional work until they went back and did over the work which they had completed and for which they had been paid.

Escaping Written Contracts

To a trite proposition of law on a very important aspect of every-day business the Oklahoma Supreme Court, in a recent opinion, adds an observation which tends to enforce integrity of contracts (Outcault Advertising Company vs. Waurika Natl. Bank, 227 Pacific Reporter, 144).

Execution of a written contract supersedes all oral negotiations concerning the terms and subject-matter of the written instrument occurring at or before the signing and delivery of the agreement, in the absence of accident, fraud, or mistake of fact. Proof of such oral negotiations may not be made for the purpose of contradicting or adding to terms plainly incorporated in the written contract.

If one is induced through fraud to sign a contract, he can avoid the agreement on that ground. But merely falsely representing to one in possession of his faculties and able to read that a writing submitted for his signature embodies a verbal understanding of the parties is not such fraud as will enable him to evade the agreement.

Release of Contractor's Surety Through Changing Work

In the case of Harlan Fuel Company vs. Wiggington, 262 Southwestern Reporter, 957, the Kentucky Court of Appeals lately held that the sureties of a contractor were not released from liability on the bond by changes in the work not shown to have been authorized by the owner. The Court said:

"While the evidence of Condra [the contractor] is to the effect that work was done not required by the plans and specifications and an additional expense was thus incurred by him, the evidence is not clear that the company [the owner] made any change in the plans or that any additional work was done by its orders. The corporation is only bound by the act of its authorized agent, and its rights are not affected by any deviation from the contract made by the contractor without its authority. But if, after the bond was given, it changed the contract and made material additions to the work not provided for in the specifications, the sureties were released from liability on the bond.

"'It is well settled and undisputed law that a surety is only bound by the very terms of his contract; and that if the creditor does any act which, in contemplation of law, alters the surety's liability, increases his risk, or deprives him, even for a moment, of the right to pay the debt and assume the position of the creditor, or of his right to seek indemnity, the surety is thereby discharged, and the fact that the surety may not have been actually injured is immaterial.'"

He Who Runs *Must* Read

That defendant signed a contract for excavation without reading it, because he was in a hurry to catch a train, did not enable him to avoid the binding effect of the contract terms, held the Oregon Supreme Court in the case of Lovell vs. Potts, 226 Pacific Reporter, 1111. In the course of an extended opinion, the Court said:

"'It will not do,' says Mr. Justice Hunt, in the case of Upton v. Tribilcock, 91 U. S. 45, 23 L. Ed. 203, 'for a man to enter into a contract, and, when called upon to respond to its obligations, to say that he did not read it when he signed it, or did not know what it contained. If this were permitted, contracts would not be worth the paper on which they are written. But such is not the law. A contractor must stand by the words of his contract; and if he will not read what he signs, he alone is responsible for his omission.'

"In the case of Chicago, etc., Ry. Co. v. Belliwith, 83 Fed. 437, 28 C. C. R. 358, Mr. Justice Sanborn said:

"'A written contract is the highest evidence of the terms of an agreement between the parties to it, and it is the duty of every contracting party to learn and know its contents before he signs and delivers it. . . . If one can read his contract, his failure to do so is such gross negligence that it will estop him from denying it, unless he has been dissuaded from reading it by some trick or artifice practiced by the opposite party. . . . This is a just and salutary rule, because the other contracting party universally acts and changes his position on the faith of the contract.'"

Legal Phases of Employment Contracts

In the bankruptcy proceedings against one Moran, a building contractor (299 Federal Reporter, 222), claim was made against his estate for damages on account of breach of a contract of employment. Disposing of the case, the United States Circuit Court of Appeals, Sixth Circuit, said, in part:

"The contracts were not month-to-month arrangements; on the contrary, they provided for a minimum annual salary, the maximum being dependent upon the amount of the profits; one-half of the guaranteed minimum being payable in monthly installments, the other half or any larger amount being payable at the end of the year. It is unnecessary for us to consider whether . . . a contract of hiring which fixes no express period of service but declares that payments at a yearly rate should be made in monthly installments is nothing more than a month-to-month arrangement. The undisputed facts as to the share that the employees were to have in the annual earnings make it clear that the arrangement here in question was to run from year to year. . . .

"Claimants were under the duty to mitigate the damages by taking other work. . . . The burden of proof is on the employer to show that the discharged employee could have obtained similar or fitting employment, and the compensation that he could reasonably have earned. This burden is not met by proof in the case that he immediately entered into business on his own account without seeking other employment and/or that at a later time he was able to get $50 a week compensation."

"Independent Contractor" Engaged in Road Work

In the case of Potter vs. Scotts Bluff County, 199 Northwestern Reporter, 507, plaintiff sought to enforce a claim against defendant under the Nebraska Workmen's Compensation Act on account of an injury sustained by him while engaged in a road-graveling job for defendant. The Nebraska Supreme Court held that he was not entitled to an award, because he was an "independent contractor," as claimed by the county, and not an "employee," as contended by him.

Plaintiff contracted to furnish the necessary tools, appliances and labor, to load, haul and evenly spread 1,500 cubic yards of gravel from designated pits upon a designated highway for 49 cents per yard. While loading gravel he was injured through an overhanging ledge of frozen earth falling upon him. Holding that plaintiff was an independent contractor, the Court said:

"While the contract specified that the work should be done subject to the instruction of the county highway commissioner, it is apparent that his only concern, or the county's concern, was in seeing that the proper kind and amount of gravel was evenly distributed over the highway. The county had no control over the men; could not hire or discharge them; could not determine the number who should be employed; could not determine how many teams should be operated; could not determine the hours of labor, the size of loads, or any of the other details. Under the circumstances, we are clearly of the opinion that plaintiff was not an employee of the county, but was an independent contractor."

National Defense Test Day

An Event of Industrial and Patriotic Significance

SINCE manufacturers of contractors' equipment and supplies will naturally be called upon in time of war to furnish a large amount of war material for the defense of our country, an analysis of the activities of manufacturers on National Defense Test Day, September 12, 1924, was made by CONTRACTORS' AND ENGINEERS' MONTHLY. The work which these companies did during the World War was remarkable, in spite of the fact that little or no preparation was possible because of governmental restrictions prior to the declaration of war in April, 1917. Preparedness, both in man power and machine power, is as necessary to prevent wars as to defend one's country.

It was found that there was an excellent spirit of cooperation between the manufacturers and the Government in making National Defense Test Day a truly useful event. This cooperation took every form from purely patriotic meetings for the benefit of employees to actually taking the first steps which would be necessary for industrial mobilization, were a war of defense imminent.

Metal lath played a prominent part in the last war in replacing the sandbag in the front-line trenches, for building huts for troops in training, and for clearing-stations and base hospitals. Heavier meshes of metal lath were used in the construction of reinforced concrete floors and roofs in buildings to be utilized for the manufacture of explosives and ammunition and for reinforcing concrete runways for airships and airplanes at naval and military aerodromes. Ammunition magazines and storage sheds for artillery were of stucco on metal lath construction. The metal lath manufacturers, through the Associated Metal Lath Manufacturers, mobilized as completely as possible on National Defense Test Day to show their willingness to meet the demand of the nation for preparedness.

Among the interesting reports from manufacturers, we take pleasure in quoting the following:

The Huber Manufacturing Company, Marion, Ohio, states that no attempt was made to mobilize the industries in its district, but that its employees as individuals supported National Defense Test Day practically without exception.

O. C. Dahlman, Koehring Company, Milwaukee, Wis., reports that C. S. Stewart, one of the engineers of the company, who is a captain in the Engineers Reserve Corps, made a short talk on the work and aims of the Reserve Corps, to all the employees.

George W. Cravens, Vice-President and General Manager, Climax Engineering Company, Clinton, Iowa, reports that his company had a general meeting of all employees in the afternoon to give them a good idea as to the meaning of Defense Test Day and its importance to the future of the country. "We have made a survey of the productive possibilities of our company so that we will be prepared to take on more work for the Government in case of necessity. We believe that the industry, as well as the individuals in the country, must stand back of the Government. Otherwise, the time will soon come when there will be no such thing as free United States. The spread of radicalism and class feeling is so strong that no man knows when it is liable to break out, at least in the form of civil war, if not in international war. There have been a great many efforts made to smooth things over by pooh-poohing the possibilities, but that doesn't change the facts in the least."

R. A. Dunning, Clyde Iron Works Sales Company, Duluth, Minn., reports that his company played an important part in the activities in Duluth. The industrial division of the parade in which most of the able-bodied citizens took part was headed by the Clyde Club, and the company's workmen turned out practically en masse. J. R. McGiffert, Vice-President of the company, was Chairman of the Citizens' Committee, and other officials of the company were prominent in the activities of the day.

W. G. Hall, of the Wickwire Spencer Steel Corporation, reported that a member of the Manager's Staff attended a meeting of the reserve officers and representatives of industry in the office of the Chief of Ordinance in the New England District at Boston. A parade of military and industrial units was held in Worcester during the evening of National Defense Test Day, a number of the company's men participating in the parade, as well as several of the nurses, who marched in the Red Cross section.

L. R. Fulton, Ames Shovel & Tool Company, Boston, Mass., reports that this company, including its several manufacturing plants, steel mill and handle plants, has always been in a position to furnish the Government on immediate notice with shovels and other implements of their manufacture to the maximum quantity of their production output. In the late war they were able immediately to divert their entire product to the Government's use, and it is the aim of the organization always to be in position to do the same thing again should the occasion arise. The personnel of this organization and its many units is composed almost entirely of American citizens; and while they are now engaged in the manufacture of shovels for commercial use, Mr. Fulton states that "still we are ready on a moment's notice to cooperate in whatever measures of national industrial preparedness are necessary to preserve continued peace."

Repair, Rebuild, Reroof, Now!

CONTRACTORS are well acquainted with the "Clean-up and Paint-up" campaigns of past years and the "Own Your Home" campaigns. The Lehon Company, Chicago, Ill., has now instituted for the second year a "Repair, Rebuild, Reproof, Now!" movement which holds great possibilities for retailers of lumber and for contractors.

The Lehon Company, manufacturers of Mule-Hide roofings and shingles, have instituted an aggressive campaign to put this slogan across in such a way as to benefit the entire building and contracting trades.

Reinforced Concrete Cribbing

Permanent Cribbing Rapidly Replacing Deteriorating Crib Material

THE cost of monolithic retaining wall construction has increased so rapidly in recent years that engineers have cast about for an economical substitute. Such a substitute was sought some time ago in the form of reinforced concrete cribbing, and has recently been developed in the Type H concrete units made by the Massey Concrete Products Corporation, Peoples Gas Building, Chicago, Ill. This type of cribbing has now been in service long enough and in a sufficient number of places to show its economy and practicability. The cribbing consists of two units. The units that are laid longitudinally with the wall at the front and back are called stretchers, and those with the T-shaped heads extending within the wall and tying the stretchers together are called headers.

STREET SCENE BEFORE BUILDING A CONCRETE CRIBBING RETAINING-WALL

These units when laid up form a cellular wall 6 feet thick which should be battered 2 inches or more per foot of height and backfilled with the earth or whatever fill material is available at the site. A wall of this character retains the earth behind it in the same manner as a monolithic gravity wall and may safely be erected with a 2-inch batter to a height of 12 feet.

This type of construction has a number of distinct advantages over monolithic walls. It costs considerably less in place than monolithic construction, not only because less material is required, but particularly because of the low cost of erection. Any ordinary bridge gang can erect the wall without equipment. The units can be easily handled by two men. Since one cell can be built at a time, the material excavated for an adjoining cell can be used as back-fill, thereby minimizing the handling of fill material.

No foundation is necessary for this type of wall except in very soft ground. There are no dowels nor any exposed metal to rust and cause failure of the wall. The simplicity of the units makes it possible to handle and ship them with a minimum amount of breakage. This concrete cribbing has 100 per cent salvage value. Changes or additions to a wall can be made without difficulty, and if it is necessary to remove a section the units taken out can be stored and used again. This type of cribbing wall allows free drainage of the material in the wall, and in the fill behind it. The manufacturers do not advocate the use of closed face cribbing, because in some cases the accumulation of water in the earth behind the wall may increase the pressure to a damaging extent. In this cribbing there is an open space of 5 inches, which allows ample drainage. Although it might appear that this open space would result in excessive leaching, it has been proved that there is actually little or no leaching after the earth has settled.

The headers are made 4, 6 and 8 feet long, suitably reinforced and cured. They measure 5 x 6 inches in cross-section with the T's extended 2½ inches. The stretchers are 6 feet long and 6 inches square, weighing 225 pounds, while the headers weigh 164, 225 and 287 pounds for the 4-, 6-, and 8-foot lengths respectively. The headers have ½-inch bevels at the ends and the stretchers have a ½-inch bevel the entire length of the piece.

SAME SITE AFTER CONSTRUCTION OF RETAINING-WALL, SHOWING IMPROVED APPEARANCE AND INCREASED SAFETY

John M. Egan Joins Brick Association

THE Illinois Paving Brick Manufacturers' Association has announced that it has engaged John M. Egan, Jr., of Aurora, Ill., as chief engineer, with headquarters at Springfield, Ill. Mr. Egan will cooperate in a consulting capacity with engineers, public officials and the public in general in order to promote the proper design and construction of modern brick pavements.

Twelve-Foot Threaded Bolts Raise Steel Span

Fixed Span Thrown into Channel 36 Feet Deep Raised in Unique Manner

By Max Sommers

EARLY in the spring of 1924 a 780-ton wooden freighter, measuring 193 feet in length, missed the open draw of the Southern Pacific Company's steel railroad bridge at Coos Bay, Ore., and crashed full speed into the fixed span, pushing it from its pier, turning it over on one side, and throwing it into the bottom of the bay. The bay at this spot is one of the roughest waters along the coast and is 36 feet deep. When bids were asked for removing the submerged span, few contractors desired the job, and only three bids were opened. The award was made to Booth & Pomeroy, bridge contractors, Portland, Ore.

J. H. Pomeroy drew up a plan for lifting this 180-foot steel span, which weighed fully 300 tons. A temporary piling was built over the wreck at a cost of $600, and by means of 14 pairs of 35-ton jacks and threaded bolts, each 12 feet long and 2½ inches in diameter, the steel span was lifted and placed on barges in 8 days. The job required the services of only 16 men.

CLOSE-UP VIEW SHOWING CABLES HOOKED TO THE HEAVY BARNACLED SPAN, LIFTING IT BODILY FROM THE OCEAN

SPAN ON BARGE AWAITING CUTTING UP FOR RAIL SHIPMENT

J. H. Pomeroy said that the principal problem to be confronted in handling this job was to devise a means of tightening the hold so that when the jacks were slacked down none of the lift already gained would be lost. A steel cable was passed through an eye welded to the end of each bolt that was hooked to the submerged span, and a nut and steel plate at the bottom of each jack made it possible, when tightened, to slack the lifting jacks after they had run out full without losing any of the lift.

Mr. Pomeroy claims that the record time was made because of the select union, $9.00-per-day, men that they employ on all jobs. This job was considered by government experts as one that would require fully three to four months, and the sheer simplicity of Pomeroy's plan raised doubt as to its ultimate success.

About Reckless Bidding

A NEW high record in volume of building should not be necessary each year to insure a profitable business. The assertion should never be made that jobs are being let at "profitless prices" because there are not enough of them to go around. There should never be a mad scramble to land a job, regardless of whether there is profit in it or not. Some contractors seem to think that because they have the organization and the will to engage in construction it is "up to them" to get a job on which to expend their energy. When they fail to register a low bid in the field of competitive bidders a few times, they throw caution to the winds and cut their bids on subsequent jobs more and more until they land a contract. Later they are more than apt to be sorry they got it.

It is much better and cheaper to close up the

office and go a-fishing than to take construction work at prices which do not permit a profit.

The construction industry expanded rapidly during recent years. The volume of building in any previous year was outdistanced in 1922, and the 1922 record was passed in 1923. Construction reports show that the total volume of construction during 1924 up to the present time has been large, although not equal to the volume of 1923. Notwithstanding the visible evidence to the contrary disclosed in the record of building permits and the published reports, many say that there is a serious depression in the construction industry.

The fact is that there are a great many more firms in the business among whom to divide construction, and there has been a scramble for jobs.

Competition should not be carried to the point where contractors pay for the privilege of doing the work. Each job should be figured to show a fair and reasonable profit. If the construction industry is to be maintained on a satisfactory basis, it will be necessary to do this. If ordinary business safeguards and precautions are to be thrown to the winds in figuring jobs, the inevitable result will be a badly damaged and inefficient industry, with many failures and generally chaotic conditions. Contracts taken at a loss are not in the interest of the public any more than in the interest of the construction industry. The fact cannot be too strongly emphasized that both owners and constructors suffer alike in the long run when jobs are figured at a loss.

There may be some consolation to those who figure on a safe and sane basis that the reckless ones who cast caution to the winds are not apt to remain in the business very long—but the trouble seems to be that each year brings its fresh crop of reckless bidders. —*The Improvement Bulletin.*

Don't Coast Trucks Down Hill

By F. A. Whitten

Chief Engineer, The General Motors Truck Company

NEVER "coast" your truck down a hill. By this we mean do not descend a hill with a truck, loaded or empty, with your clutch disengaged.

By leaving your clutch engaged your motor assists in braking the truck and also relieves the brakes themselves of part of the strain and helps keep them from "burning." It is also better not to shut off the ignition because if you do so on a long hill, the excess gas which accumulates during the descent may cause an explosion of sufficient force to ruin your muffler when the ignition is turned on again at the bottom of the hill. In addition, it causes the carbon to form quickly.

"Coasting," in many states, is against the law because it is conducive to traffic accidents due to the fact that a loaded truck may burn out its brakes or attain such a speed as to get beyond control on a steep hill. In addition, reengaging the clutch with the truck traveling at high speed can do almost irreparable damage to a truck. Most motor truck engines are governed at a specified speed. If a truck traveling down a hill with clutch disengaged attains a speed of 35 to 40 miles per hour and its engine is governed at, say, 25 miles per hour, imagine what will happen if the clutch is reengaged with truck and engine running at these respective speeds.

If the load is sufficiently heavy the entire driving mechanism may be torn out of the truck, or the least that may happen is the ruining of one of the propelling units.

Care should be taken in gear shifting. A green driver should in all cases be "broken in" by an experienced one until he "knows" his gear shift almost instinctively.

Last of all the driver should "keep up the momentum" of his truck in heavy going. He should never let the speed of his truck diminish to the "laboring" point before he shifts. The purpose of the transmission is to provide locomotion under all road conditions and failure to "shift" when it is necessary causes unnecessary strain.

Contracting—and Loaded Guns

"HE was a good fellow—but reckless," said the sympathetic friend of the deceased, brushing away a silent tear as the little knot of mourning relatives and friends slowly departed from the cemetery.

"He was always willing to take a chance. When he was a mere lad at school he saw a sign over an orchard gate one day. It said: 'Beware of the Dog—He Bites.' He walked into the orchard and picked an apple off a tree to see if the dog would really bite.

"It would.

"The next winter while skating, a friend pointed out a warning—'Danger—Thin Ice.' He skated over the place to find out if the ice was really thin.

"It was.

"Two years later he got a job with a road contractor. He was driving a big paver when he came to a bridge on which was a placard, 'This Bridge Unsafe for Loads of More Than Four Tons.' He drove across it to learn if it would not carry an eight-ton load.

"It would not.

"He went to work for a wrecking contractor and the boss told him not to go near the old brick wall they were about to pull down because the wind was apt to dislodge the loose bricks at the top. But he went close to the base of the wall to see if any bricks would fall.

"They did.

"An uncle left him money and he became a general contractor. His friends told him that unless he carefully checked up all his estimates and included a reasonable profit he would soon be parted from his money.

"He was.

"Three days ago he saw a sign on a rusty old shotgun. It said: 'This Gun Is Loaded.' He looked down the barrel to see if it was really loaded.

"It was." —*The Improvement Bulletin.*

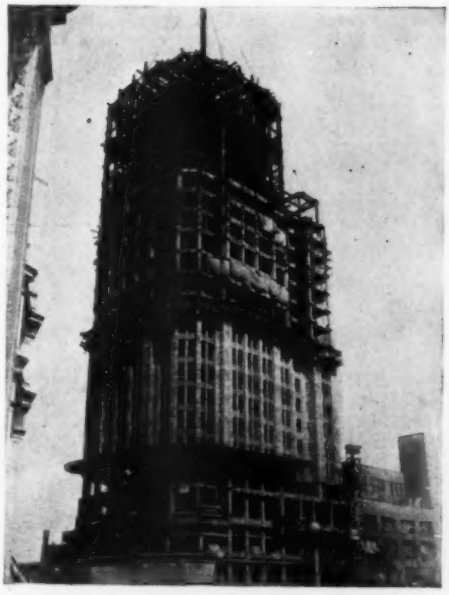
35-Story Chicago Tribune Tower Nearing Completion

Slender Structure Has Strong Wind Bracing

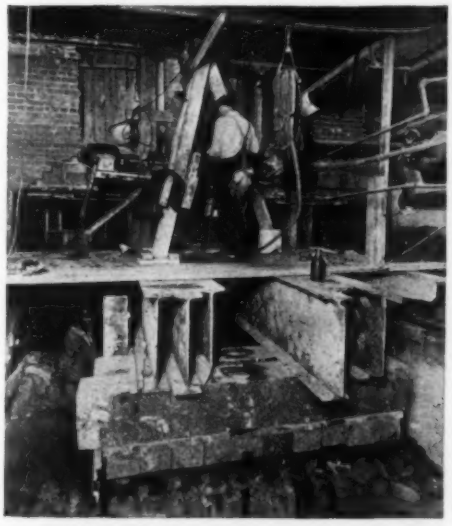
THE various subcontractors on Chicago's tallest building, the new Tribune Tower, are making excellent time. It is plain to see that both the design of the structure and the building of it are in line with modern ideas in construction. It is fully realized that production, whether of a mechanical or a structural nature, is almost entirely a material-handling problem, since the individual man's job is pretty well standardized. The avoidance of delay and the speeding up of the job rest largely upon foresight in the matter of getting materials to the job, not just delivered to the site but to the man who is doing the work, and accomplishing this without confusion or delay and without carrying unnecessarily large amounts of materials to him at any one time. Careful consideration of this phase of construction and the standardizing on good equipment cannot help but greatly reduce construction costs. Five Thomas electric hoists furnish ample hoisting equipment for the contractors at the Tribune Tower, including the derricks and the two double-cage elevators.

The Tower is located opposite the new Wrigley Tower, just north of the Boulevard Link Bridge on Michigan Avenue. The ball on the flagpole which will surmount the huge revolving searchlight to be placed at the top of the building will be 560 feet above the upper Michigan Avenue level. The lower or traffic level is some 33 feet below that.

The Tribune Plant, the production end of the newspaper, was built in 1919 in back of the site now occupied by the Tower. It has a huge one-story pressroom running out in front of it at the lower level, almost to Michigan Avenue, and occupying much of the space now under the Tower. This made construction awkward to a certain extent, and it presented a real engineering problem, since it became necessary to sink caissons under the pressroom without stopping the presses for a moment. This was complicated by the presence of several caissons which were put in when the plant was built, in anticipation of an office building to come. Subsequent change of plan resulted in the present structure, throwing existing caissons out of line in some cases and making it necessary to sink heavier ones in others.



THE NEW TRIBUNE TOWER UNDER CONSTRUCTION



PUTTING NEW FOUNDATIONS UNDER THE PRESSROOM

The R. C. Weiboldt Construction Company, of Chicago, handled the foundation and substructure, bringing the building up to the upper level. To get at the caissons that were to be drilled out and to dig new ones, they sunk holes outside the walls of the pressroom, tunneled under it and jacked up the entire building and presses. Daily readings were taken to keep the presses in perfect alignment. When it is considered that a press won't operate if it is the least fraction of an inch out of true, and that among the presses was the world's largest, 217 feet in length, it is seen that considerable skill and thought went into the work.

The contractor standardized on Thomas single electric caisson winches, one of which is shown pulling a caisson, with the pressroom running on regular schedule above. There are 68 caissons in

all, resting on bed-rock and an average depth of 110 feet below the Chicago ground level.

The boiler-room is in the sixth subbasement, 64 feet 9 inches below the Michigan Avenue level, and the ash-pit is 9 feet 9 inches below that. Hopper-bottom coal cars are brought up alongside the building, and the coal is dropped directly into bunkers adjacent to the boiler-room. Ashes are conveyed to the Chicago Tunnel, which connects with the building at the 31-foot, 6-inch level. Rolls of news-print come in on cars brought up on the same siding and are rolled across a platform and distributed to various presses on chutes. Provision is made for a unique conveyor system for handling the printed papers. As they come from the press, they are picked up between a double parallel row of endless coiled steel springs running on roller guides. This conveyor takes them up and across the ceiling of the pressroom around a couple of 45-degree curves and onto the next floor, where they are bundled, tied and conveyed to the waiting trucks, which operate from the lower or traffic boulevard level, solving another materials-handling problem.

Since the Tower is so tall for its width and depth, strong wind bracing is needed. Very little space was left for this at times, but a rigid bracing of beams in X-shape was placed between columns where possible, and heavy gusset plates were used where beams were too bulky.

In one room, designed for paper storage, the headroom was so low that ceiling beams would be in the way, so a concrete slab ceiling, reinforced two ways, was used. It rests on cantilever steel beams supported by steel uprights.

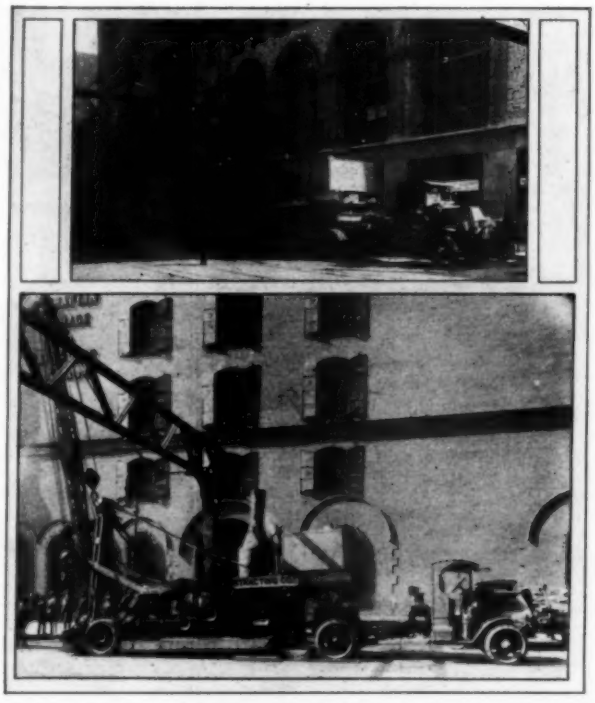
The work is all so carefully planned, supervised and coordinated that little delay is experienced anywhere. Hageman Harris are the general contractors, and Howells & Hood are the architects. The Chicago offices of CONTRACTORS' & ENGINEERS' MONTHLY are to be located in the Tribune Tower as soon as it is completed.

Ingenious Wrecking Contrivance of New York Contractor

The Story of the Removal of the 42nd Street Shuttle in New York City

THE portion of 42nd Street between Park Avenue and Third Avenue, New York City, until a few weeks ago was darkened by the shadows of the shuttle line of the Third Avenue Railway. Since this shuttle was very little used, it had been practically abandoned. It had always detracted from property values, hindered traffic and marred the beauty of adjacent buildings, and therefore it was finally decided to demolish the structure.

The wrecking contract was awarded to the Harden Construction Company of Brooklyn, owners of the ingenious wrecking device shown in the accompanying illustrations. This apparently complicated contrivance was designed by W. F. Harden, and has been used on construction and wrecking jobs in the vicinity of New York for over 12 years. The remarkable feature of this apparatus is the manner in which all of the mechanism, including the engine, drums and boom, is assembled into one compact, portable unit. The large water-tank mounted on the upper sills is unique, in that it serves a double rôle. It functions as a water-supply for the engine, but its real purpose is to counterbalance the weight of the boom, which has a lifting capacity of 25 tons. When moving to a new location, the tank is drained, thereby materially reducing the weight of the machine.



UNIQUE PIECE OF WRECKING APPARATUS REMOVING 42ND STREET ELEVATED STRUCTURE

The entire equipment is mounted on a specially designed semi-trailer, which is hauled by a 15-ton Mack tractor. At first a 12-horse team was used as motive power, but the tractor has increased the efficiency of the unit by adding speed to its transportation and by its ability to back and to negotiate sharp turns in traffic.

The Question of Doing Business as a "Foreign" Corporation

Taking Contract to Erect Bridges as "Doing Business" within State

By Leslie Childs

THE question of what constitutes "doing business within a state," under the interpretations of statutes that require foreign corporations to file articles before entering a state, is one of vital importance to contractors, engineers, and construction executives in general. This is true because statutes of this kind frequently impose severe penalties for their violation, and a contracting corporation that runs afoul of their provisions may suffer a substantial loss of time and money.

As an illustration of the possible danger to a corporation in taking a contract in a foreign state, in the absence of positive knowledge of the scope of such a state's foreign corporation laws, the Arkansas case of Kansas City Structural Steel Company, vs. State, 256 S. W. 845, is well worth a brief review. The facts and circumstances which culminated in the action were, as gathered from the report, as follows:

Contract to Build Bridges Entered Into

In this case the Kansas City Structural Steel Company, a Missouri corporation, made a bid upon a contract to construct certain bridges in Ashley County, Arkansas. Its bid was accepted, and on May 3, 1921, it entered into the contract without complying with the Arkansas statutes which required foreign corporations to file articles when "doing business" within the state.

Pursuant to this contract, the company sublet a part of the work to another company, and made shipments of steel, bolts, reinforcing rods, steel piers, tubes and angles for use by the subcontractors in the bridges. Following this, on August 17, 1921, the company secured a permit to do business within the state, and complied with the Arkansas laws in respect to foreign corporations entering the state.

Thereafter the instant action was brought by the state against the company for doing business within the state, as a foreign corporation, in violation of the Arkansas statutes. This action was predicated on the acts of the company in entering into the contract and making shipments before it complied with the Arkansas corporation laws on August 17.

In defense to this action the company contended that its acts prior to August 17 did not constitute doing business within the state, its claim being that the entering into the contract and the shipping of materials was a transaction in interstate commerce and not subject to regulation by the state laws.

Judgment Rendered Against Company

Upon the trial of the case in the lower court, a finding was made against the company, on an agreed state of facts. Pursuant to this, the trial court rendered a judgment against the company in the sum of $1,000. The company prosecuted an appeal from this judgment to the Supreme Court of Arkansas, where, in reviewing the evidence and passing upon the question of whether or not the company had been doing business within the state in violation of the law, it was, among other things, said:

"It appears that appellant (Kansas City Structural Steel Co.) came into this state and bid on the contract for the construction of bridges * * *; that its bid was accepted, and the contract entered into in this state for the construction of these bridges; that prior to the day when it obtained its license to do business in this state it had sublet a portion of the work * * *; that before it was authorized to do business in this state appellant also shipped the structural steel necessary for the bridge work consigned to itself at Wilmot, Ark. * * *

"These acts separately (and certainly taken as a whole) looking towards the fulfillment of its contract to construct the bridges which was entered into, and to be performed, in this state constituted the doing of business in this state, and the Court was correct in so holding. * * *"

Conclusion

In the light of the facts and holding of the foregoing Arkansas decision, it is obvious that before a contract for work in a foreign state is undertaken by a corporation, the corporation laws of such state should be carefully investigated relative to the necessity of complying with them before entering the state. If the nature of the contract is such that it can be clearly performed as a transaction in interstate commerce, the state foreign corporation statutes will not of course apply.

However, this is the point to be decided in each case of this kind by the foreign corporation's engineer or other executive who has charge of entering into contracts. And certainly it is incumbent upon such an officer to be certain of his ground, before obligating his company, for, as we have seen in this case reviewed, a violation of a statute of this kind may result in a substantial loss to the company. In view of which the case reviewed becomes one of force and value on the point decided, and its facts and holding may well be had in mind when bidding on a contract in a foreign state.

Legal Decisions

"Legal Points for Contractors," on page 55 of this issue, is a regular department which many readers have found helpful. In addition, articles by Leslie Childs will appear from time to time.

Making Concrete More Workable

Workability Is Defined as the Degree of Effort Required in Handling and Placing Concrete in Such Manner as to Give a Uniform and Homogeneous Finished Product

EVERYONE who specifies or uses concrete is interested in workability. The specifier or engineer is primarily interested in securing a uniformly homogeneous concrete of sufficient strength to meet his design. He is also interested in securing a good-looking piece of work, which depends to a large extent upon the workability of the concrete. The contractor is primarily concerned in having a concrete which will work easily, as that simplifies his problems, increases the efficiency of his crew, improves the appearance of the finished structure, and reduces his costs.

The workability of ordinary concrete can be improved. The safest and most economical method of securing this desirable feature is by adding hydrated lime to the mix.

Many experienced men have long known that hydrated lime improves concrete construction, and have added hydrated lime to practically all their concrete. However, some have claimed that a definite and substantial increase in the workability of concrete due to the use of hydrated lime could not be accepted until it was proved in the laboratory, even though it was proved in the every-day practice of responsible engineers and contractors. This desired scientific proof has now been secured.

At the February, 1924, convention of the American Concrete Institute, held in Chicago, Ill., a paper entitled "Economic Value of Admixtures" was presented by J. C. Pearson, Chief of the Cement Section, United States Bureau of Standards. This paper reviewed the results obtained by Messrs. Pearson and Hitchcock in their laboratory on the effect of powdered admixtures such as hydrated lime, kaolin, celite and three calcium chloride preparations on a variety of concrete mixes.

The effects of hydrated lime, which material can be secured wherever portland cement is handled, are of particular interest to the building industry, as they clear up the doubts which some have had, and confirm the well-established opinion of our foremost concrete engineers, architects and contractors.

An intensive study was commenced in 1922, and a paper was presented before the 1923 Convention of the American Society for Testing Materials by the same authors as previously mentioned. In the introduction to their 1923 paper,* they say:

"It is not easy to define the terms 'workability,' 'plasticity,' 'consistency,' etc., as applied to concrete mixtures. Some authorities use these terms more or less synonymously; others prefer to distinguish between workability and consistency, considering the latter as a property directly related to water content and measurable by the slump, flow and other tests, whereas workability is regarded as more intrinsically a characteristic of a given mixture, dependent not only on the water content, but essentially upon the other ingredients of the mix. We incline to this latter view, and without attempting to give an exact definition of workability, we consider one concrete mixture more workable than another when the processes of mixing, handling and placing are accomplished with less effort in the one case than in the other."

Later in the same paper they stated: "If we use the term 'workability' to mean, not merely the degree of effort required in handling and placing concrete, but the degree of effort required in handling and placing concrete in such manner as to give a uniform and homogeneous finished product, then we may declare that the results of the penetration tests confirm our judgment on the workability of concrete mixtures."

The foregoing brief discussion of the term "workability" presents in a few words the thought that many have had. It indicates that "fluidity" due to the use of excess water combined with careless handling and placing does not give the desired result, and at the same time indicates that these difficulties may be easily overcome.

In their 1924 paper before the American Concrete Institute, Messrs. Pearson and Hitchcock state: "The question is of considerable economic importance, for if by any means a mortar or concrete mixture can be made more plastic and still serve its ultimate purpose satisfactorily, it means a saving in labor cost, and a more uniform product under given labor conditions. We believe that the importance of this question has been grossly underestimated, probably for the reason that there has been no answer to it."

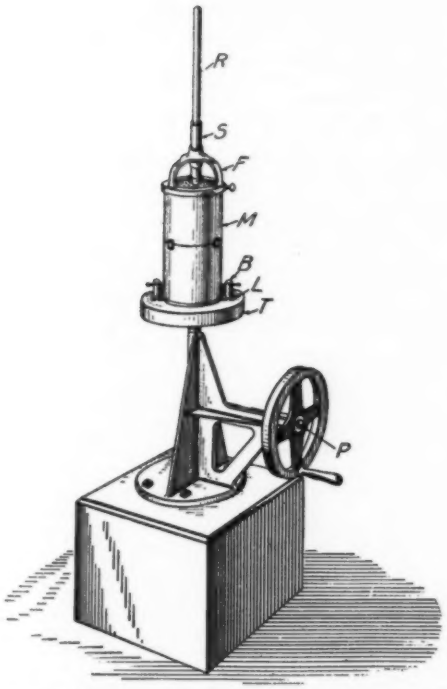
Type of Apparatus Used

The investigators devised a test, which, while simple, gives results which check and which agree with practice. The apparatus used is shown below and its functions are described by the authors as follows:

"The apparatus is shown below, in which M is a 6-inch by 12-inch cylindrical mold with a tight bottom, mounted upon a small table which can be raised and dropped about 1/10-inch by means of a cam. A spider F is mounted on top of the mold carrying a sleeve S into which a close fitting steel rod about 20 inches long can be introduced in alignment with the axis of the mold. In our most recent experiments the rod is tapered to a 45° cone on its lower end, and is graduated in such manner that the depth of the lower end below the top mold is read directly.

"The batch of concrete to be tested is placed uniformly in the mold and first compacted by 30 drops of the table, then the rod is inserted in the sleeve and lowered gently into the concrete until it comes to rest under its own weight. The cam shaft is then turned and the mold full of concrete is successively raised and dropped in such a manner as to allow a reading on the rod after each impact. The test is regarded as complete when the rod has penetrated the concrete to a depth of 11 inches. From the data of the test a penetration curve is obtained * * * *. It is obvious that the richer or more plastic the concrete mixture, the more readily will the rod penetrate to the prescribed depth, and the number of im-

* A. S. T. M. Proc., 1923, Vol. 23, Part II, p. 276.



APPARATUS FOR MEASURING THE WORKABILITY OF CONCRETE

pacts required to cause the rod to reach the 11-inch mark is therefore a rough index of the workability of the mixture.

"In actually making comparative tests, it is found desirable to take as an index of workability, not simply the number of impacts required to produce a penetration of 11 inches, but the area under the penetration curve. * * * *"

The following data taken from the paper mentioned show that hydrated lime improves the workability of concrete mixtures, and at the same time show that its effect upon the compressive strength is a negligible factor which may be disregarded whether it be slightly beneficial or slightly detrimental. The main facts are outstanding, and they are the practical elimination of segregation, a notable increase in workability or lubrication, greater uniformity in the finished concrete and a materially better looking, and structurally better, piece of work.

EFFECT OF HYDRATED LIME ON WORKABILITY OF CONCRETE MIXTURES

Extracted from "Economic Value of Admixtures"

Per Cent Admixture by Weight	Workability Figures 1:1½:3	1:2:4	1:2½:5	1:3:6	Average
0	44	108	169	242	141
5	33	103	167	202	
10	31	81	125	185	
15	—	—	129	171	
Av.	32	92	140	158	113

It should be borne in mind when studying the foregoing table that a high workability figure means a harsh, hard-working concrete, while a low workability figure means a smooth and easy-working concrete.

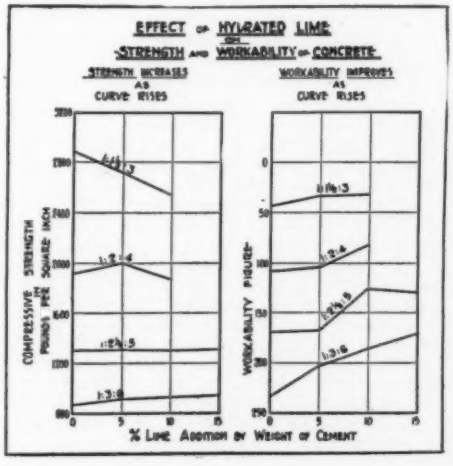
For those who are interested in noting the effect of the hydrated lime upon the compressive strength of the concrete, the following table will be found interesting:

EFFECT OF HYDRATED LIME ON COMPRESSIVE STRENGTH OF CONCRETE

Mix	Per Cent Admixture	Strength—Lbs. Per Sq. In. Curing Conditions: Damp Closet	Laboratory—Outside	Laboratory—Air	Laboratory—Average
1:3:6	0	960	800	820	860
	5	1010	870	850	910
	10	1010	880	870	920
	15	1070	870	850	930
1:2¼:5	0	1380	1270	1200	1283
	5	1430	1220	1240	1363
	10	1410	1250	1220	1293
	15	1400	1340	1170	1303
1:2:4	0	2080	1880	1800	1920
	5	2080	2050	1870	2000
	10	1980	1820	1780	1860
1:1¼:3	0	3130	2840	2700	2890
	5	2950	2620	2620	2730
	10	2710	2530	2370	2537

Effect of Density

It will also be noted from the following table that the density of the concrete is generally increased by the addition of hydrated lime. In the richest mix tested (1:1½:3), the density is reduced slightly, but in such a mix the value of hydrated lime is decidedly limited, and the figure is merely of interest. A concrete having a comparatively low density figure and at the same time being easily workable, will produce a more desirable and likewise more impermeable product than will a mix of high density combined with harsh working qualities. In general, lime confers both advantages; actually increasing both the density and workability of the mass, and thus contributes toward the desired end.



EFFECT OF HYDRATED LIME ON DENSITY OF CONCRETE

Mix	Per Cent Admixture	Density
1:3:6	0	.781
	5	.785
	10	.785
	15	.784
1:2½:5	0	.783
	5	.786
	10	.784
	15	.782
1:2:4	0	.783
	5	.784
	10	.779
1:1½:3	0	.780
	5	.776
	10	.772

In their discussion of the effects of admixtures on the density of concrete, Messrs. Pearson and Hitchcock say: "The uniformity in density throughout the entire range of concrete is remarkable. With one exception all densities lie between .768 and .787, and yet the effect of the admixtures is plainly indicated. In each of the several groups lime gives the highest density. . . . These differences, small though they are, seem to depend mainly on the water content, with little or no relation to the proportions of the solid constituents in the various mixtures."

In summarizing the results of their investigations, the authors state in part:

"The powdered admixtures in the proportions used did not seriously affect the strength of the 1:2:4 or leaner concrete; in fact, the 1:3:6 concretes were benefited by the admixtures in all cases. Considerable reduction in strength resulted from the larger proportions of the admixtures in 1:1½:3 concrete. With reference to actual concreting operations, these conclusions are conservative, for it was observed that as the workability of a mixture was improved, the tendency was to use less mixing water than was required to maintain the prescribed flow [or consistency—*Ed.*]. In other words, the more plastic mixtures seemed over-wet in comparison with the others, and more water was used in them than appeared to be necessary or would probably be used under job conditions to obtain a desired consistency. The results of the tests reported herewith indicate that a judicious use of admixtures in concretes which need improvement in respect to workability will not materially impair the strength. . . ."

Saving Due to Admixtures

"The increased yield of concrete containing powdered admixtures is in favor of the latter [all admixtures tested—*Ed.*], and in many cases is probably sufficient to entirely offset the cost of the admixture. The net saving from the use of admixtures is not in cost of materials, but rather in labor cost and greater assurance of uniformity in the finished product.

"The authors believe that the data presented herewith justify a more general consideration of the proper use of admixtures. Better and more economical concrete must result from anything that improves the plasticity or workability of the mixture, provided no deleterious effect is also involved. It has been shown that small proportions of powdered admixtures do not detract appreciably from the strength of the concrete except in rich mixtures, where the need for, and the values of, such admixtures disappear. On the other hand, the improvement that can be brought about by the judicious use of admixtures is considerable, and this must tend to reduce costs and improve the uniformity of the finished product under given labor conditions."

Admixtures vs. More Cement

The amount of hydrated lime that should be added to concrete is inversely proportional to the richness of the mix. The Bureau of Standards tests indicate that the percentage of lime may equal three times the number of parts of coarse aggregate without materially affecting the strength of the product. However, practice, substantiated by the results shown in the first two tables, indicates that maximum economic value will be secured in structural work if the percentage of hydrated lime, or pounds of lime per sack of cement, is not over twice the number of parts of coarse aggregate in the mix. Thus in a 1:2½:5 mix the maximum admixture of hydrated lime would be 10 pounds with each sack of portland cement used. Where high compressive strength is not of prime importance, as in certain classes of concrete products, bridge rails, ornamental work, etc., larger percentages of hydrated lime may be added to secure the desired results.

Analysis of the first table shows clearly the efficiency of hydrated lime in improving workability. An average of the results, based on the above-mentioned percentages, shows that hydrated lime is about 40 per cent more efficient than is portland cement in its effect on workability. With reference to the average of the admixtures reported on in the paper "Economic Value of Admixtures," the authors state: "The improvement in workability which is effected by these maximum additions is about that which should be expected by a 25 per cent increase in the cement content."

From the foregoing data and quotations, it will be seen that the value of approved admixtures has been established in the laboratory. The fact that under field conditions admixtures show up still more advantageously was further developed by G. W. Hutchinson, Engineer in Charge of Tests of the North Carolina State Highway Department at Raleigh, N. C., in his discussion of the work done at the Bureau of Standards. He says in part:

Early Uses of Admixtures

"C. M. Upham, now State Highway Engineer of North Carolina, was probably responsible for the first use of admixtures on a large-scale concrete road operation. They were used in the Colman-DuPont road in Delaware in 1915, and specified when the Delaware State Highway Department's first specifications were written. Considerable laboratory work was carried on at that time, and it was found that admixtures most available had practically little effect on the resulting strength of the laboratory concrete. The results in general showed a slight increase. When used in small proportions, it contributed a very desirable element in workability and seemed to assist in the finishing of the concrete road. Later we found that with the coarser sands there was more to be gained along workability lines than with a more finely graded type of fine aggregate. . . .

Effect on Strength

"Our experience is that in the nominal proportions of concrete with nominal amounts of certain admixtures there is no reduction in strength, but in practically all cases a slight increase is obtained, and this increase is relatively greater as the cement content is decreased. Any disagreement of test results regarding strength can probably be attributed to the various gradations of aggregates used in the different investigations. It is safe to say, however, that with any gradation of aggregate allowable for use, any decrease in strength by the use of approved admixtures would not be appreciable. In the proportions recommended for use, the test results should generally fall within the limits of test error in laboratory concrete; which will account for seeming inconsistencies in the details of tests of this nature. . . ."

"It must be realized that the strength of concrete, regarded on the basis of usual laboratory comparison, is the least of the problem to be solved. A few per cent variation from the average strength, whether an increase or decrease, is negligible. The main purpose is to control the uniformity by reducing the variable caused by manipulation. An efficient admixture of any kind which will reduce the amount of labor necessary for manipulation will not only accomplish this result, but will also reduce the cost. There is no economic advantage in design for high average strength, if accompanied by great variation throughout the structure, but there is a decided one in concrete of any designed strength possessing uniformity. . . ."

"It is extremely doubtful if the true effect of admixture on workability, strength and uniformity can be determined in the laboratory. By this I mean that there are many conditions to be met in the field that are not encountered in the laboratory work. Laboratory manipulation will counteract certain adverse conditions which the admixture is expected to correct in the field, and thus the value of the admixture is not fully brought out in laboratory tests. The virtue of the admixture lies in its ability to assist in making more uniform and workable concrete in the field. The uniformity is of decided advantage from a structural view-point, and the workability has its value with reference to the economy of placing the concrete at decreased cost, or producing a more uniform finished structure, at the same cost. The relative value of different types of admixtures will be dependent upon their ability to accomplish the desired purpose at the lowest cost. . . ."

Basing his conclusions upon a very extensive series of both field and laboratory tests and a careful study of the conditions under which the concrete was placed, Mr. Hutchinson states that:

"1. Any means for promoting workability or uniformity in concrete should function much more efficiently in the field than in the laboratory. This is due to the range of variation in the field being so much greater.

"2. If these means are accomplished by the use of powdered admixtures, the effect of such admixture on the strength would be negligible when compared with the variations actually encountered in the field.

"It will be noted that in the paper presented ["Economic Value of Admixtures"], the densities of the concrete measured vary but little. This is another point where field concrete varies from laboratory concrete, as the methods of mixing and placing, etc., of the concrete in the laboratory allow considerable more control of this factor than in the field, and therefore would not allow the admixture to function as effectively as could be expected in the field. Field concrete should be mixed with as little water as possible so that the consistency will be as dry as can reasonably be used in placing the mixture properly. It is obvious that the more workable the concrete is, the dryer it may be in consistency and at the same time be placed with the same amount of labor. Using the figures as given in the paper under discussion, it is possible to increase the workability of the concrete about 30 per cent accompanied by an increase in the water-cement ratio of about 8 per cent with practically identical strengths. In concrete road work it has been found not only desirable, but under certain finishing conditions necessary, to mix concrete of a drier consistency when the admixture was used."

Recommendations for Use

The foregoing information, based upon the data and experience of several of the most widely recognized concrete authorities in this country, demonstrates conclusively that the use of admixtures in concrete is of far more importance than has heretofore been realized. The use of hydrated lime in concrete is neither new nor novel. The recommendations here given are not arbitrary and should be varied to meet the conditions of fine and coarse aggregate encountered. A fine sand and smooth coarse aggregate will require less lime than will a coarse sand and coarse aggregate.

MAXIMUM RECOMMENDED ADMIXTURES OF HYDRATED LIME FOR IMPROVING WORKABILITY OF CONCRETE

Mix	Percentage of Lime by Weight of Cement
1:1½:3	5
1:2:4	8
1:2½:5	10
1:3:6	12

As a sack of portland cement is commonly considered as weighing 100 pounds and containing 1 cubic foot, the above percentages should be regarded as indicating the number of pounds of hydrated lime to be added to each sack of cement used in the batch. The following approximate field measurements will be found useful on the job:

HANDY MEASUREMENTS

Size of Pail	Struck Capacity Llbs. of Hydrate
4-quart	5
6-quart	7½
8-quart	10
10-quart	12½
12-quart	15
16-quart	20
20-quart	25

Where possible, measuring hoppers should be used, and the lime added at the same time as the aggregates. Where the size of the mixer or batch warrants it, either whole or half bags of lime should be used for the sake of convenience, even though it requires a slight change in the actual amount of percentage of lime added.

ACKNOWLEDGMENT.—Prepared from Bulletin 311, "Hydrated Lime Makes Concrete More Workable," issued by the National Lime Association, Washington, D. C.

Building Conditions in the United States

Prepared by S. W. Straus & Company

Construction Industry in Healthy Condition

BUILDING permits in the United States for October showed an increase of 3 per cent over October last year, also an increase of about 15 per cent over September, this year. Every section of the country except the Pacific West reported a gain over October, 1923; the South leading with a gain of 29 per cent. The East reported a gain of 8 per cent and the Central West 2 per cent, while the Pacific West had a loss of 19 per cent. The Pacific West was also the only region to show a loss from September, this year.

The October gain is indicative of a continued stable, healthy trend throughout the construction industry. The tenth month should normally show an increase over September. The gain over October a year ago is an additional indication that building is progressing at a rate which should lend strength to business in general.

The 338 cities which reported for October had a total of $305,056,214, compared with $295,571,973 in October, 1923, and $264,037,736 in September, this year. In 94 Eastern cities the figures were $136,165,166 for October, this year, $125,910,930 for October, 1923, and $109,100,702 for September, this year. In 112 Central cities the figures were $101,515,475 for October, this year, $99,392,361 for October, 1923, and $90,609,097 for September, this year. In 52 Southern cities October figures this year were $27,664,989, October, 1923, $21,395,600, and $23,031,128 for September, this year. In 80 Pacific Western cities the figures were $39,710,584 for October, this year, $48,873,082 for October, 1923, and $41,296,809 for September, this year.

The twenty-five leading cities (selected according to volume of permits issued in October, this year), reported a gain of about 4 per cent over October, 1923, and about 23 per cent gain over September, this year. This gain over October, 1923, was despite losses reported from seven of the twenty-five, including among them New York and Chicago.

While the percentages of increase over October, 1923, and September, 1924, in these leading cities are slightly greater than the percentages of increase reported from the 338 cities for corresponding periods, it is nevertheless evident that building is progressing proportionately throughout the country.

TWENTY-FIVE CITIES SHOWING LARGEST VOLUME OF PERMITS FOR OCTOBER, 1924, WITH COMPARISONS

		October, 1924	October, 1923	October, 1922	Sept., 1924
1.	New York P. F.	$60,519,647	$63,575,797	$48,955,851	$45,748,315
2.	Chicago	23,830,350	27,837,350	14,996,150	20,228,200
3.	Detroit	14,952,086	12,485,880	8,657,180	12,524,789
4.	Philadelphia	12,066,625	10,949,310	9,876,025	8,665,805
5.	Los Angeles	11,057,277	20,541,872	11,580,427	13,090,467
6.	St. Louis	9,032,225	2,111,695	2,957,283	2,783,960
7.	San Francisco	6,116,313	3,793,374	4,719,394	5,671,784
8.	Cleveland	5,702,150	5,733,300	2,928,875	4,833,725
9.	Atlantic City	4,183,993	590,994	677,527	3,698,756
10.	Washington, D. C.	4,048,236	2,273,096	3,303,018	4,379,062
11.	Milwaukee	3,805,359	6,051,673	2,166,079	6,992,512
12.	Boston P. F.	3,712,274	3,556,341	2,605,286	3,906,119
13.	Pittsburgh	3,255,584	2,061,448	2,503,486	1,985,234
14.	Youngstown, Ohio	3,082,220	515,840	420,355	742,840
15.	Baltimore	2,966,600	3,083,990	3,810,480	2,737,000
16.	Dallas	2,769,282	1,006,380	1,344,500	2,472,733
17.	Denver	2,769,200	2,386,600	1,484,500	3,002,150
18.	Oakland, Calif.	2,619,703	2,759,208	2,316,833	2,502,144
19.	Kansas City, Mo.	2,594,872	2,397,450	1,883,750	1,708,150
20.	Buffalo	2,591,712	2,306,000	1,648,000	1,635,536
21.	St. Paul	2,519,232	1,700,608	1,438,910	1,394,438
22.	Birmingham	2,487,594	1,544,183	861,580	1,293,797
23.	Portland, Ore.	2,429,195	2,136,360	1,519,185	2,548,575
24.	Newark, N. J.	2,253,908	2,733,463	4,200,602	1,558,284
25.	Hartford	2,219,490	1,385,905	674,875	954,547
		$193,585,127	$185,473,117	$137,530,151	$157,058,921

NOTE—P. F. indicates figures are for plans filed instead of permits issued.

SUMMARY OF OCTOBER, 1924, REPORT BY REGIONS

No. Cities	Regions	October, 1924	October, 1923	Sept., 1924	Gain or Loss Oct.-Oct.	Gain or Loss Oct.-Sept.
94	Eastern	$136,165,166	$125,910,930	$109,100,702	$10,254,236 + 8%	+$27,064,464
112	Central	101,515,475	99,392,361	90,609,097	2, 23,114 + 2%	+10,906,378
52	Southern	27,664,989	21,395,600	23,031,128	6,269 389 +29%	+4,633,861
80	Western	39,710,584	48,873,082	41,296,809	9,162,498 —19%	—1,586,225
338 cities	Total	$305,056,214	$295,571,973	$264,037,736	$9,484,241 + 3%	$41,018,478 +16%

Bidders' Bonds Versus Certified Checks

The Writer Shows in "The American Contractor" That Bid Bonds Are Easily Secured, and Are Not a Sufficient Guarantee of a Contractor's Worth

By A. E. Horst

Secretary-Treasurer, Henry W. Horst Company, Rock Island, Ill.

IN many instances, laws are such that they permit a bid bond to be attached to a proposal for public works. But on account of technicalities that are not easily discovered, if the contract were awarded to an exceptionally low bidder the bid bond might not be of any value whatever. For this reason, the use of bid bonds seems to be on the wane in many states and localities.

It appears that these bid bonds are and have been issued by underwriters without carrying any obligation on any of them to bond the bidder in case he is successful. Under these conditions, the bid bond would appear to be worse than useless, and for that reason should be eliminated in all localities in which this is the case. This type of bid bond was formerly in effect in New York, but was dispensed with there some years ago.

The Bid Bond Has Some Advantages

Some of the advantages of submitting bid bonds with proposals at highway lettings are that no interest needs to be paid on the amount of the bid bond, nor are contractors' funds tied up if exceptional delays are caused in awarding contract; whereas the use of certified checks requires that the contractor must decide several days in advance on just which projects he will bid. The amount of his bid on each of these projects also must be determined in order that he may secure the proper amount and number of certified checks for each project, and see that these certified checks are properly delivered to the place at which the letting is to be held. This is, of course, exceedingly difficult, especially at times when the contractor is bidding on work several states distant from his home office.

When certified checks are required at highway lettings, a smaller number of bids apparently are submitted than when bid bonds are in use; but there still is ample competition. It is true that when bid bonds are permitted in lieu of certified checks, bids are submitted by many who have not the experience, the capital, or the equipment to warrant their bidding on the large projects they do bid on.

Certified Checks Involve More Work

When we analyze the procedure in securing certified checks and the procedure in securing bid bonds, we find in the one case that it is necessary for the contractor to secure certified checks from a banking institution, and in the other, from some representative of a bonding company. In order to secure, say, a $50,000 guarantee, much more preparation, explanation, and backing are required to secure certified checks totaling this amount than to secure bid bonds in this amount from some one of the many representatives of the bonding companies, especially when there are so many bonding company representatives who have the authority to give out these bid bonds.

In a given community there probably are five or six banks that might be willing to give a contractor certified checks totaling $50,000. In this same community there probably are three times as many representatives of bonding companies who would have authority to give bid bonds for much larger amounts if they so desire; so that the chances of an irresponsible contractor's securing a bid bond in this community in lieu of a certified check are at least three to one, since only the judgment of the representative of the bonding company is involved. And his judgment might be influenced because he is paid a substantial commission on the performance bond premium; whereas in the case of the bank, the cashier or the president authorizing the certified check secures but the regular rate of interest, which goes not to his personal benefit, but to the institution he represents.

In other words, the representative of the bonding company is interested in making a bid bond because he personally secures a substantial commission for doing so if the contractor secures the award, whereas the banker personally secures nothing. Therefore it is not difficult to understand that the bank is going to be very sure that the contractor is in proper shape to handle the work before giving him a certified check, while the bond agent will endeavor to write as many bid bonds as possible at a letting in order to increase his chances of securing for himself personally the commissions derived from a successful award.

Almost all bid bonds are written the day of the letting, when not as much consideration of the actual facts can be given as when certified checks are arranged for in a very deliberate way days in advance of a letting.

It is common knowledge that at some of the highway lettings there were many bid bonds written for contractors that were not even reported to the bonding company's executive offices by agents writing them, indicating how far these practices have gone in the promiscuous writing of bid bonds by representatives of the bonding companies who happened to have the blank forms to execute. It also is known that some contractors have been given blank forms of bid bonds to fill out for whatever amount they saw fit.

The Evil of the Situation

The fact is recognized that there have been altogether too many irresponsible representatives of bonding companies writing bid bonds for irresponsible contractors and that the executives of some of the better class of bonding companies do not intend that this practice shall prevail. Nevertheless, it does prevail; and until it is eliminated, certified checks, which are not given out without serious consideration, seem to be a better guarantee and indicate that the contractor who uses them has used due diligence, and that he is properly qualified for the work.

Another advantage to the contractor in the use of a certified check is that he may select the bonding company with which he may wish to place the performance bond when awarded the contract, which he may not be in a position to do before his bid is submitted. He also may elect, if it is permissible, to place personal collateral as an earnest of good faith in performing the contract rather than a surety company bond, which may be less expensive to the owner and quite as effective as a surety company performance bond.

The Case for the Prosecution

In general, therefore, the opponents of the bid bond cite the wholesale and promiscuous distribution of blank forms by surety company agents, which, as indicated above, apparently throws the gates open to any one who tabulates figures.

It is held that a great number of irresponsible companies that know nothing of estimating, and perhaps less about contractors' managing and financing, and that have no financial backing, are able to submit proposals. Once these proposals are submitted, the bidder secures a surety bond, which he invariably can, and the state is obliged in most cases to award him the contract. On the heels of this action follows the whole gamut of dissension, evasion, and improper performance on the part of irresponsible companies that bring suspicion on all contractors and keep public construction in a state of demoralization.

It is my opinion that if certified checks—and certified checks only—were required at highway lettings, and the amount of the certified check were somewhere between 7½ and 10 per cent of the bid, the tendency would be to secure bids only from contractors who are responsible to carry out the work on the basis of their proposals, and in accordance with plans, specifications, and time of completion. Contractors would be much more careful in building up their proposals, because of the fact that their own perfectly good certified check, worth that much of their own cold cash, which they alone are responsible for, could be held as liquidated damages if their bid were accepted and they refused to enter into contract.

Miscellaneous Notes

New Holt Distributor

THE Dukehart Machinery Company, 106-110 West Second Street, Des Moines, Iowa, has been appointed distributor for Holt Caterpillar tractors in Iowa, with the exception of the counties adjacent to Nebraska. A. G. Forney, formerly the Holt sales representative in Central Iowa, is associated with the Dukehart Machinery Company.

Chausse Opens Elkhart Factory

THE Chausse Oil Burner Company, has announced a change in its address to Elkhart, Ind., where it has completed a new factory on West Beardsley Avenue in conjunction with The White Manufacturing Company, with which it is associated. The factory which these companies have been occupying in Goshen was seriously damaged by fire a short time ago. The new plant, which is constructed entirely of brick, steel and cement, has double the facilities of the old one for the production of Chausse kerosene torches, tool and surface heaters, as well as The White Manufacturing Company's line of railway car parts.

Waukesha Motors Used

WE have been advised by the Shaw-Enochs Tractor Company, 2416 University Avenue, S. E., Minneapolis, Minn., that its tractors have been powered with Waukesha motors since the first of this year. We are pleased to make this correction of the statement made on page 81 of the September, 1924, issue of CONTRACTORS' & ENGINEERS' MONTHLY.

The Heil Mechanical Hoist

THE Heil Company, Milwaukee, Wis., has acquired the patents and patterns of the Titan mechanical hoists for motor trucks and very soon will be able to furnish this hoist for mounting on any make or model of truck. The hoist will be known as the Heil mechanical hoist. It has a high dumping angle, is of light weight, weighing approximately 400 pounds.

The Front Cover Illustration

THE front cover illustration of this issue of CONTRACTOR'S & ENGINEERS' MONTHLY shows a Parsons Model 30 trench excavator made by the Parsons Company, Newton, Iowa. This machine was sold in the spring of 1923 to the Rocky Mount Public Works Department, Rocky Mount, N. C. L. M. Jordan, Superintendent of the Gas Department, says in a letter regarding the performance of this machine:

"The first ditching job that we had after unloading the machine netted us a saving of $707.50 on 4½ days' work, as compared with manual labor at the present wages. This was on a gas line trench 3½ feet deep by 18 inches wide, the machine averaging 1,700 feet daily. On the next job, a sewer ditch 6½ feet deep by 2½ feet wide, the machine averaged 71.7 feet per hour and netted a saving of $883.20, making the actual total savings for these two jobs $1,590.70. The sewer ditch was cut in 14½ hours' actual digging time."

On another job, the same machine cut a ditch approximately 7½ feet wide and about 7 feet deep to take the place of a meandering stream. The work was done at about one-quarter of the cost figured out. The machine dug the ditch in three cuts.

Cost figures furnished by Mr. Jordan show that this Model 30 trench excavator dug 7,650 feet of gas ditch 3½ feet deep and 18 inches wide, averaging 1,700 feet daily, at a total cost of ¾-cent per foot, or $57.50. The estimated cost with labor was 10 cents per foot, or $765 for 7,650 feet, saving on this job $707.50.

On 1,040 feet of sewer ditch 6½ feet deep and 2½ feet wide, which was dug in 14½ hours' actual digging time, or at the rate of 71.7 feet per hour, the total cost of the ditch was $55.80, or 5½ cents per lineal foot. The estimated cost of labor was 85 cents per foot, or $889 for 1,040 feet, making the saving on this job $833.20.

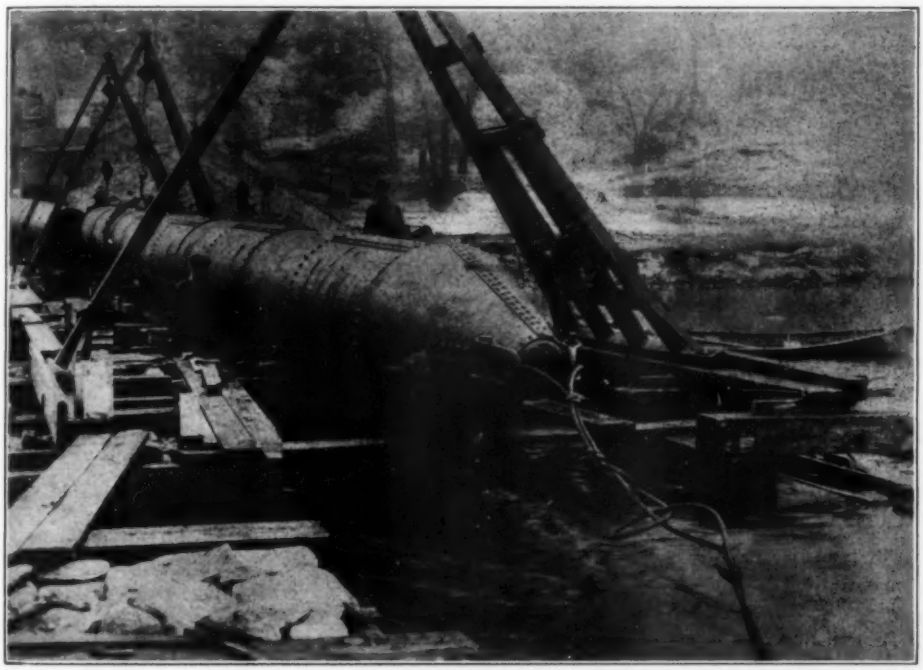
Laying a Subaqueous Water-Main at Minneapolis

Four-Foot Pipe Laid Across Mississippi River Under Difficulties

WHEN the Minneapolis water distribution system required the crossing of the Mississippi River just below the Falls of St. Anthony with a 48-inch riveted steel pipe ½-inch thick, the engineers were faced with a problem. The river at this point passes through a gorge some 900 feet between bluffs, which are, on the east side of the river, each a height of about 100 feet above low water, and on the west side, 72 feet. On the east side there are 39 feet of sand and gravel to the Trenton lime rock; on the west side, about 11 feet from the top of the ground to the lime rock, which is of the same elevation on both sides of the river. This rock is 25 feet thick and separated from the underlying St. Peter sandstone by 3 feet of shale. The St. Peter sand rock is some 800 feet thick. The river has cut through the rock, and the river bottom is filled with broken débris of lime rock and boulders; at the deepest point about 40 feet, then the sand rock.

In order to make this crossing, 8-foot shafts were sunk on both sides of the river, and 8 x 7-foot tunnels extended from the shaft to the edges of the bluffs, 340 feet long on the east side and 60 feet long on the west side, and trenches were dug on the shores as far as possible. Work was started in January, 1923. As the current is very swift at all stages of water, it was necessary to do the river work proper in extreme low water, which occurs from the end of December to the middle of March, mostly in weather below zero. The problem was, how to excavate the trench in the material mentioned. Pile driving was impossible, and the water was too swift and shallow to permit the use of a dredge.

It was decided to build cribs 4 feet wide and 8 feet long, made of 10 x 12-inch timbers, with partly planked bottoms, each to be loaded with about 2 tons of rock. These cribs were placed about 14 feet apart on centers across the river, and 16 feet on centers up and down the stream. On these cribs across the river, 24-inch I-beams 28 feet long were laid flat to form a running-track for the excavator, which was a stiff-leg derrick fitted with grooved wheels which traveled on 40-pound rails laid loose on the I-beams. The plan at first was to handle a ½-yard orange-peel bucket with this derrick. Before building the cribs some excavation was done with this rig on the low shore on the west side, and it seemed as if the material could be handled that way. Accordingly, the placing of the cribs across the river was carried through and the runway completed from shore to shore.



TORPEDO HEAD OF RIVETED STEEL PIPE HAULED ACROSS THE RIVER AT MINNEAPOLIS, MINN.

The derrick was then sent back to the west end, and excavating operations continued with the orange-peel bucket, but as soon as the river was reached it was found that the bucket would not

work satisfactorily at all, and the rig for excavating was changed by attaching to the boom of the derrick a dipper stick, placed about 20 feet from the end of the boom, with a ¾-yard steam shovel dipper. The excavation with this machine commenced February 18 and the ditch was finished March 17. It was a very difficult piece of work. The material was exceedingly hard to handle; big pieces of ledge from earlier erosions were often encountered and they had to be dragged out. Some 2,500 yards of this stuff was excavated and dumped on the down-stream side. All small material was immediately washed away by the current, leaving the heavier stuff in place. As the excavation progressed towards the east side, the cribs were removed. I-beams were placed on the spoil bank as a track to carry the cribs, timbers and I-beams back to the west shore. These beams also formed the pathway between the excavator and the west side.

On March 21 riveting the 30-foot sections of the 48-inch pipe was begun, and on March 26 the work of pulling the pipe toward the east shore was started. The first section pulled had a torpedo-head to which a ⅞-inch plow steel iron-center pulling cable was attached, fastened with Crosby clips, as shown in the illustration. This first section was 120 feet long. There were also two lugs on the inside of the torpedo head, to which a ⅞-inch plow-steel cable was fastened with Crosby clips. This cable was kept anchored to the west bank. The pulling was done with an American hoisting engine through two sets of triple blocks. After the first section was pulled, 30-foot sections were added and pulled. On March 30, a total of 486 feet of pipe had been pulled out over the river, and another day would have landed the end on the east shore. However, luck was against the engineers in charge and on this very day the ice broke in the upper river—about two weeks ahead of the usual time—and a big ice gorge, which had formed about 15 miles above the falls, broke, releasing a flood of about 54,000 cubic feet per second, which is very nearly the maximum flood record on the upper Mississippi since 1860, when 60,000 to 65,000 cubic feet came down. The flood picked up the heavy pipe like a straw and laid it down-stream on the flat west shore, only shearing part of the rivets in one joint at about the middle of the pipe. The inside cable anchored on the west shore saved the pipe. A few days afterwards, ten million feet of logs broke away at Anoka, 18 miles from Minneapolis, and came down over the falls and cleaned out the spoil bank, I-beams and all. The beams were picked up later.

After such a series of mishaps nothing could be done until the river went down again. In July the pipe was taken from where the flood had left it, straightened, joints repaired and tested, and placed in position for handling again under low-water conditions. Meanwhile, the work of building shafts and tunnels had gone on, and was completed on May 27. The shafts were lined with concrete and the tunnels with 6-inch vitrified tiling.

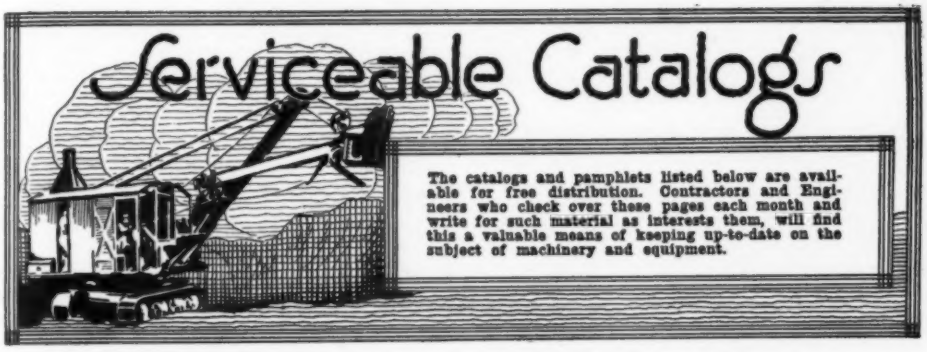
The flood had completely filled the ditch with sand, gravel and smaller boulders, and it was decided that the surest and best way to clean it out would be with a dragline excavating outfit. This was arranged as follows: The track cable was started from a 14 x 14-inch mast, 48 feet high, set up on the east shore. The elevation of the cable hitch was about 116 feet, the west end of the cable being fastened to a bridle cable subject to pull up or down stream, with a set of ¾-inch double blocks at an elevation of about 31 feet. The total span was about 980 feet. The track cable was 1¼-inch plow steel, the load line was ⅝-inch plow steel, and the tension line was ¾-inch plow steel. All fastenings were made with Crosby clips, and an American hoisting engine rated at 25 h.p., with a steam pressure of 125 pounds, was used with a ½-yard bucket. A 20-h.p. engine was placed on the west side. Setting up the cable and engine began September 11, and dragline excavation on the river proper began October 16, and was finished on the 20th of January, 1924.

On January 22 the pulling of the river sections of the pipe was begun again and this phase of the work was finished on January 31. The last pull was about 15 feet of a total length of pipe of 698 feet. This, together with the constant wetting to which the cable and clips were submitted, furnished a severe test, which, however, showed the equipment well able to meet all requirements. As the pipe was pulled and sections added, water was let into it on the west end so as to keep it just about afloat above the bottom of the trench. It was gradually lowered into place from the west end, and closed in and riveted by February 9. On the east end, a coffer-dam had to be built over the pipe, to permit cutting off the torpedo-head, putting in the remaining sections and making connections with the end of the pipe at the mouth of the east tunnel. Much trouble was experienced in unwatering the coffer-dam, as sand rock was encountered inside the dam and no puddle clay could be secured because of the extreme cold weather, about 20 degrees below zero at that time. However, the east end work was closed in on March 10.

As soon as the pipe had been properly placed, on February 12, the work of anchoring it started. This was done by placing very coarse fabric bags filled with sand and cement mixed 1:4 around the pipe, filling the entire trench in spots. Ten such anchors were placed, containing 18,000 sacks. The sand and cement were delivered at the top of the west bluff. The sand was heated and mixed dry with the cement in a small mixer and the sacks filled, slid down a plank chute, wheeled to the river edge, then loaded on the drag line bucket, which was fitted with a platform large enough to hold twelve bags. The engine on the east bank pulled the bucket out over the pipe in the river, and the engine on the west bank pulled it back. As soon as the sacks had been thrown into place, holes were punched in them with sharp-pointed rods to speed up the wetting of the contents. The cement set satisfactorily and the work was completed March 3.

On March 21 the entire work on the east side was completed and the coffer-dam removed. With everything ready, the expected flood came on April 4. The ice gorge broke about 14 miles above the falls and came down very violently, but without doing any harm to the main, and the débris carried by the flood water served to fill up the remaining open portions of the pipe trench.

ACKNOWLEDGMENT.—Text and illustration by courtesy of the *Crosby Clipper*, published by the American Hoist & Derrick Company, St. Paul, Minn.


Serviceable Catalogs
The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up-to-date on the subject of machinery and equipment.

POWER-FORCE PUMP UNITS

The Domestic Engine & Pump Co., Shippensburg, Pa., in its Bulletin 23-F, describes its power force pump units which are adaptable for use as temporary water-system units for road builders, contractors, well drillers and for other work.

A BACK-ACTION SHOVEL FOR TRENCHING

The trench Pull-Shovel, made by the Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill., specially for drainage and sewer trench digging, works on the principle of the dragline in that it backs away from its work. This shovel is described in literature which may be secured free on request.

SMALL GASOLINE POWER UNIT

The value of a Novo gasoline engine for handling all kinds of contracting problems, in pumping, running concrete mixers and portable electric light plants and handling pile-driving jobs, is told in an interesting manner in "Novo Power," which may be secured free from the Novo Engine Co., Lansing, Mich.

A TRACTOR-MOUNTED HOIST

The White hoist, made by the Oklahoma Engineering & Foundry Co., Muskogee, Okla., which can be built into the rear end of a Fordson in about four hours, providing a powerful portable hoist for all kinds of contracting work, is described in literature which may be secured from the above company.

A MOBILE SWINGING CRANE

The Otis swinging crane, with a capacity of 1-ton on an 8-foot boom and a swing through 180 degrees, has been developed by the Otis Engine Corp., 247 Park Ave., New York City, for mounting on a Fordson tractor to provide it with extreme mobility. This crane is described in literature which may be secured free by any interested contractor.

END- OR SIDE-DUMP BODIES

Gammon dump bodies, which are made to dump either from the end or at the side, are described in the literature of the Pechstein Iron Works, Keokuk, Iowa. These bodies are made in ¾- and 1-yard capacities.

EFFECTIVE PLOWS FOR GRADING

The Ferguson unit-type plow, made by the Roderick Lean Mfg. Co., Mansfield, Ohio, and described in its literature, is particularly adapted to ripping up soil where it is desired to load with a drag-scraper outfit.

AUXILIARY AXLES

The Ruckstell axle for Ford 1-ton trucks, made by the Ruckstell Sales & Manufacturing Co., Berkeley, Calif., when installed in place of the usual Ford rear axle, gives four forward speeds in place of two. This equipment is described in the free literature of this company.

PATROL GRADERS

Three types of Patrol and Junior graders for one-man operation, in conjunction with light-weight tractors, are described in the literature of the Russell Grader Mfg. Co., Minneapolis, Minn.

A TRACTOR COMPRESSOR UNIT

An air compressor, one end of which is supported by a castor wheel, and the other by a Fordson tractor, and which is belt-driven from the tractor, is described in the literature of Schram, Inc., Westchester, Pa.

AN AUTOMATIC SCRAPER HITCH

An automatic scraper hitch to attach any 5-foot Fresno, Sidney or Royal Buck scraper to a Fordson tractor, has been developed by the Gustav Schaefer Wagon Co., 4180 Lorain Ave., Cleveland, Ohio, and is described in its printed matter.

A WORM-DRIVEN PORTABLE HOIST

Worm-driven hoists which may be attached to the front of a Fordson tractor to give mobility, all of the gears and bearings for which are standard equipment parts, are described in detail in the literature of the Sheffield Tool & Supply Company, Sheffield, Pa.

MAKING CONCRETE MORE WORKABLE

The use and value of hydrated lime in making concrete more workable is described in detail in Bulletin 311, which may be secured free from the National Lime Asso., 218 G St., N. W., Washington, D. C.

POST-HOLE DIGGERS

In its catalog No. 23, the Seymour Mfg. Co., Seymour, Ind., illustrates and describes the Atlas, Eureka, Hercules, Perfection, Lone Star, Seymour, Hexagon, Champion, and Stricklin pattern post-hole diggers and the Iwan and Vaughan pattern post-hole augers.

CONCRETE PRODUCTS EQUIPMENT AND MACHINERY

The Besser Sales Co., Monadnock Bldg., Chicago, Ill., has issued a loose-leaf catalog describing its complete line of concrete brick and tile machines, intermittent and continuous batch mixers and semi-automatic and hand-operated block machines.

A TRACTOR-GRADER ATTACHMENT

A Fordson attachment for Winner road graders, made by the Good Roads Machinery Co., Inc., Kennett Square, Pa., is described in Bulletin K. T. R., which street and highway officials and contractors will be interested in securing.

AN INTERCHANGEABLE DUMP EXPRESS BODY

An interchangeable dump express body which can be used either with an automatic gravity, quick-acting vertical hoist or with an underbody hoist, for Ford one-ton trucks, is described in the literature of the Hughes-Keenan Co., Inc., Mansfield, Ohio.

A TRUCK BUILT FOR ROAD WORK

A truck which is built with excess power and is able to handle a 1-yard batch of wet concrete or 1½ yards of dry aggregate, is described in the literature of the Hug Co., Highland, Ill.

GRADERS WITH ROLLER-BEARING WHEELS

Austin leaning wheel graders with Timkin tapered roller-bearing wheels are described in detail in a new illustrated catalog which may be secured from the Austin-Western Road Machinery Co., 400 N. Michigan Blvd., Chicago, Ill.

A MELTING AND HEATING KETTLE

A new indestructible oil-burning heating kettle which insures quick, safe and economical melting and heating of bituminous material, such as asphalt, tar and binder, is described in the illustrated literature of Chase & Lyman, Inc., 12 Pearl St., Boston, Mass.

AN ASPHALT CONCRETE PAVING BLOCK

The Keystablock, a well-keyed paving block, 3½x4x 12 inches, made with a surface of asphalt and a base of concrete, is described in the literature of the Keystabond Asphalt Paving Co., Inc., 367 Boylston St., Boston, Mass.

A NEW PONY ROAD ROLLER

In its latest catalog the Acme Road Machinery Co., Inc., Frankfort, N. Y., describes its 5-ton, 4-cylinder gasoline road roller, which has a wheel-base of 97 inches and is powered with a Fordson unit.

COMPOSITE ASPHALT STORAGE, HEATING AND PUMPING OUTFIT

In Bulletin V-863, which may be secured from Warren Brothers Co., 9 Cambridge St., Boston, Mass., municipal engineers and contractors will find a complete description of a composite asphalt storage, heating and pumping outfit, including all of the equipment necessary for its operation as an economical unit for handling asphalt in bulk.

GUARANTEED ENGINES

Alamo engines, made by the Alamo Engine Co., Hillsdale, Mich., which have quality, power and reliability, are described in a well-prepared 24-page illustrated catalog which contractors interested in 1½- to 15-horsepower portable engines may secure on request.

REINFORCED CONCRETE CRIBBING

In catalog supplement No. 19 issued by the Massey Concrete Products Corp., Peoples Gas Bldg., Chicago, Ill., contractors will find a very interesting and thorough discussion of reinforced concrete cribbing and its advantages.

A CONCRETE PAINT THAT RESISTS RAIN

The Truscon Laboratories, Detroit, Mich., will be pleased to send complete information to any interested contractors regarding its Stone Tex, a rain- and weather-resisting paint which is applied with a brush to exterior masonry.

HAND-OPERATED ROTARY SCREENS

In the literature of the F. S. Converse Co., Inc., Johnson City, N. Y., contractors will find a complete description of a hand-operated rotary screen which is capable of handling light materials or small quantities of sand or gravel very effectively.

SAVE MONEY WITH PORTABLE AIR POWER

In an illustrated 72-page catalog, "100 and 1 Ways to Save Money," the Ingersoll-Rand Co., 11 Broadway, New York City, describes its complete line of pneumatic tools and portable air compressors.

A BLEEDER FOR TREATED WOOD BLOCKS

The Chausse Oil Burner Co., Elkhart, Ind., has just brought out a new squeegee machine for the forced bleeding of tarred and creosoted block floors and pavements. This machine is described in detail in literature which may be secured free on request.

A NEW 8-TON, 4-SPEED GASOLINE LOCOMOTIVE

The Fate-Root-Heath Co., Plymouth Locomotive Works, Plymouth, Ohio, describes its new type 6 model DLC 8-ton, 4-speed gear-drive gasoline locomotive for contractors, in its latest illustrated literature, which contains condensed specifications.

AN IMPROVED SEMI-TRAILER DUMP BODY

Complete information regarding the adaptation of the Hydro hoist to a semi-trailer dump body which makes it possible to haul heavy loads under present state laws may be secured from the Heil Co., Milwaukee, Wis.

A GUIDE TO THE USE OF SHEET METAL

The Milcor Architectural Sheet Metal Guide, which has recently been issued as Catalog No. 24, by the Milwaukee Corrugating Co., Milwaukee, Wis., is a helpful reference book on the use of metal tile and shingles, roof trimmings, sheet metal and roll roofings, ornamental cornices and canopies, metal ceilings, ornamental gutters and zinc and copper architectural ornaments.

BETTER TRANSITS

Contractors should realize that the accuracy of much of their work depends on good transits run by good engineers. A good engineer cannot work well with a poor transit. Folder P-1 with a free pocket booklet of instructions of interest to users of transits and levels on construction work may be secured from the Warren-Knight Co., 136 N. 12th St., Philadelphia, Pa.

SPADES THAT ARE SPADES

Shovels, spades and scoops which are honestly made of the very best materials of proper weight and balance, bearing the well-known Ames trade-mark, which is a protection and guarantee to the contractor, are described in the literature of the Ames Shovel and Tool Co., 90 Ames Bldg., 1 Court St., Boston, Mass.

STEEL FORMS FOR CONCRETE ROADS

Unevenness of side forms is an inexcusable construction defect and results in an uneven concrete surface. Contractors wishing information on steel forms which do not sag and which hold their alignment, should write to the Blaw-Knox Co., Pittsburgh, Pa., and ask for that company's steel road form booklet.

STEAM SHOVELS BUILT TO LAST

It is not always the number of dipperfuls a shovel will dig in a day or a month that determines whether it is a good buy, it is the showing the shovel makes as the years go by. Complete information on the long service of Thew power shovels run by steam or gasoline will be found in an interesting folder which may be secured free from the Thew Shovel Co., Lorain, Ohio.

MACHINE DOES WORK OF 4 TEAMS AND 6 MEN

The Miami Trailer Co., Troy, Ohio, has just issued a well-illustrated folder, 4300-B, which completely describes its Fordson-one-man power scraper unit which handles as much dirt on grading work as 4 teams and 6 men.

A COLORED CONCRETE WATERPROOFER

In its latest Colormix booklet, the Master Builders Co., Cleveland, Ohio, describes in detail this concrete hardener, waterproofer and dustproofer, which is made in permanent colors, including red, brown, green, two shades of gray, buff, black and white.

POWER DRAG SCRAPERS

Pamphlet No. 24, which has recently been issued by Sauerman Bros., 464 S. Clinton St., Chicago, Ill., is a well-illustrated, interesting book, describing the complete line of Sauerman power drag scrapers and outlining the advantages of the different types of drag scrapers, hoists and cableways.

A CRAWLER BLAST-HOLT DRILLING OUTFIT

In Bulletin CR-44, the Loomis Machine Co., Tiffin, Ohio, describes in detail the new Model 44 Loomis "Clipper" gasoline crawler blast-hole drill for contractors and quarrymen.

A RAPID HAND DUMP

The "Quicktrip" one-ton steel dump body and hoist, made by the New York Central Iron Works Co., Inc., Hagerstown, Md., for Ford trucks, should be of interest to contractors, judging from the description which appears in new literature which has just been issued.

A COMPLETE LINE OF PORTABLE MIXERS

The Archer Iron Works, Chicago, Ill., has just issued a particularly well-illustrated 16-page catalog describing Archer portable mixers, which load and discharge quickly. This includes the well-known Archer Auto-Mixer and Speedmobile mounted on Ford trucks.

MODERN FOUNDRY CONSTRUCTION

The Truscon Steel Co., Youngstown, Ohio, will be pleased to send to any interested contractors and engineers a copy of its booklet on the building of the grey iron foundry of the Studebaker Corp. at South Bend, Ind., which is fully equipped with Truscon steel windows and mechanical operators.

CONCRETE MIXERS FOR ALL NEEDS

A contractor wanting to know about a complete line of concrete mixers should secure catalog No. 35 issued by the Construction Machinery Co., Waterloo, Iowa, as the catalog contains a complete description of all types of Wonder concrete mixers.

VALUE IN CONCRETE MIXERS

"Panama" batch concrete mixers, which the manufacturers claim give the greatest values per pound of mixer and dollar of cost, are described in the literature of the J. B. Foote Foundry Co., Fredericktown, Ohio.

THE DEVELOPMENT OF RAILROAD POWER SHOVELS

The Osgood Co., Marion, Ohio, has just issued a very interesting illustrated booklet which gives a brief history of the development of standard railroad shovels and describes the new Osgood continuous treads for this type of power shovel.

TRACTORS FOR ROAD WORK

Contractors needing a medium weight tractor for handling road work, earth moving and grading and for plow purposes, should secure the latest literature of the Cleveland Tractor Co., Cleveland, Ohio, describing its Cletrac tractor, a medium-weight unit.

REAL FACTS ABOUT 7-S MIXERS

In "The 7-S Mixer Book," the Leach Co., Oshkosh, Wis., manufacturers of Leach-Oshkosh concrete mixers, has printed a number of reports of inspections which were made independently by the Robert W. Hunt Co. of all makes of 7-S mixers.

AUXILIARY TRANSMISSION FOR FORDS

The literature of the Warford Corp., 44 Whitehall St., New York City, gives complete information regarding the Warford auxiliary transmission for Ford trucks, used by more than 30,000 companies and municipalities. This is a selective type transmission using both underdrive and overdrive, giving 2-ton capacity and pace-making speed at 1-ton operating cost.

OIL-BURNING PATROL PATCHING HEATERS

The new Connery Style P-1 oil-burning patrol patching heater, which is useful for heating small quantities of tar, pitch, asphalt or bituminous filler in connection with asphalt, brick and granite, stone or wood block paving, is described in literature which may be secured from Connery & Co., Inc., 4000 N. Second St., Philadelphia, Pa.

ENGINES FOR CONTRACTING MACHINERY

In order to get the most out of any piece of contracting machinery, it must be powered with an engine which is reliable. The Climax Engineering Co., 1 W. 18th Ave., Clinton, Iowa, will be pleased to send to any contractor a list of the manufacturers of contractors' machinery who use Climax "Trustworthy" engines as standard equipment, and a list of the sales and service stations for these engines.

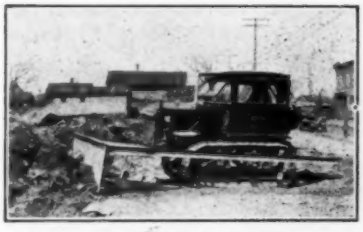
USEFUL DATA ON REINFORCED CONCRETE CONSTRUCTION

The Consolidated Expanded Metal Companies, Braddock, Pa., has issued a well-illustrated, interesting 18-page booklet containing useful data pertaining to Steelcrete expanded metal products for reinforced concrete and cement construction.

A Back-Filler Attachment for Heavy Tractors

Bull-Dozer Also Excellent Device for Leveling Dumps

THE handling of loose material quickly and effectively has been expedited by the development of the LaPlant-Choate Bull-Dozer or trench back-filler, which will take the place of hand shoveling in leveling off the loose heaps of material at city dumps, and as an outfit for sewer and drainage contractors for refilling trenches. Money spent for labor in doing this class of work will soon pay for one of these outfits, and the contractor or municipality will be the owner of the outfit after the work is done. With this strong machine, water conditions do not make much difference, as when attached to Holt, Monarch or Best tractors, it can handle even frozen material.



THE "BULL-DOZER" BACKFILLING

The LaPlant-Choate Manufacturing Company, 3015 First Avenue, Cedar Rapids, Iowa, had tried out many different devices prior to placing this one on the market. This Bull-Dozer is the result of the accumulated knowledge with tractor plows and from experience gained in the field. It is built to extend out far enough in front of the tractor, to allow the tractor to stay on firm ground so that the blade will hang out over the edge of a deep fill and not get the tractor in the soft material. The single blade is hinged at the top so that in reversing it will rise and slide back without dragging any material with it. Furthermore, the blade is equipped with two steel runners on the reverse side to help it slide back.

The main frame of the Bull-Dozer is made up of two 5-inch I-beams, 16 feet long, strongly reinforced in front with two cross-braces, and tied in the rear with two 5-inch I-beams, which are quickly removed by means of four pins. The pivot bearings are bolted to the swing frame of the tractor and on the underside of the main plow frame. This bearing supports an offset axle which passes under the transmission case and thence to the opposite side through bearing on the opposite side of the main frame. This method of suspension is balanced by putting on rocks and sand-bags on the rear of the cross-bar deck to equalize the overhanging weight of the blade. The frame is guided from the track of the tractor by means of a vertical guide attached to each side of the rear end of the tractor swing frame.

The blade is elevated by means of a worm-geared hoisting drum attached to the rear drawbar of the tractor by an angle-iron upright. The cable is attached to the winding drum, thence through a pulley and then up to the rear cross-tie of the main frame. A flexible coupling with the shaft attached to a 16-inch hand-wheel on the upper end is attached to the winding drum. The hand-wheel is at the rear of the cab so that the driver can easily raise or lower the blade from the cab. The push blade itself is of steel, ¼-inch by 3 feet by 8 feet. The blade is perfectly straight. and is heavily reinforced with ⅜ x 3 x 4-inch angle-irons at the top and bottom. The lower angle is reinforced with a truss rod and turnbuckle. The upper end of the blade is at-

LEVELING A DUMP WITH A "BULL-DOZER"

tached to the main frame by means of a hinged joint attached to the opposite side of the main frame beam. This allows the push blade to swing free in reversing. When the tractor reverses, the push blade automatically rises and is supported by two curved running-shoes attached to the rear side and reinforced by a brace on the underside of the main frame. The lower face of the curved runner has a renewable ⅝ x 3-inch half-sole. The ⅝ x 3-inch iron braces on the main frame just back of the curved runner lock the blade firmly in place when the plow is in action. The curved runners give approximately 6 inches clearance of the blade from the ground in reversing, so that the blade does not drag material back with it. The lower edge of the Bull-Dozer blade is fitted with a carbon steel grader cutting-blade bolted to the Bull-Dozer blade, and can be removed for sharpening whenever necessary after continued rough service.

A Hand-operated Rotary Screen for Light Materials

Outfit Originally Designed for Reclaiming Anthracite Screenings Has Many Possibilities in Contracting Field

FIFTEEN years ago the F. S. Converse Company, Inc., Johnson City, N. Y., offered a machine for reclaiming anthracite screenings. Recently this screen has been improved, and it is being used by contractors for screening sand, cinders and gravel in small quantities.

The screen cylinder is made in sections each of a differently spaced wire cloth, through which the various sizes of the material are sifted. In this way the material is assorted into lots of uniform size. The use of wire cloth instead of perforated metal in the construction of the cylinder is a very important feature. The wire cloth has a large screening capacity and in addition a very rough surface. With the perforated metal the material would slide along over the smooth surface without sifting thoroughly, while the roughness of the wire cloth helps to hold the mass until that which should sift through has fallen out. In this way in a smaller screen a uniform grading of material is assured.

ROTARY SCREEN OPERATED BY GAS ENGINE SET ON SKIDS

Each section of the cylinder is made of two half-sections, each 2 feet or 3 feet long, removable and interchangeable, so that screens of different size spaces can be substituted. Each complete section fastens on simply and securely by six bolts. All of the half-sections are made in exact sizes, and no trouble is encountered in substituting one for another.

A clogged screen reduces the capacity of any machine for work. The Converse rotary screen has an automatic cleaner. Over the first section, which is the finest screen and the one that becomes clogged most easily, is a steel frame on which is hung a hammer terminating in a steel roller. On the cylinder is a steel band, made with sprockets, which, in revolving, strikes against the roller in the hammer, throwing it up several inches. In falling, this hammer gives the cylinder a heavy stroke, jarring the screen free from the particles that clog it.

On the cylinder shaft is a sprocket-wheel to which power is transmitted by a chain from a smaller sprocket on the counter-shaft on the side of the screen. To the counter-shaft is attached a crank for hand power, or a pulley or sprocket for other power.

The cylinders are made 24 inches, 30 inches and 36 inches in diameter, the first being 36 inches long and the other two 24 inches long. To facilitate moving, the screen is equipped with casters, which are raised so that the screen stands on legs when in use. The casters are easily raised and lowered by means of two levers. The sections are commonly equipped with ¼-inch space wire cloth for the first section, ½-inch space for the second, and ¾-inch space for the third. However, these sizes may be varied in accordance with the service to which the screen is to be put.

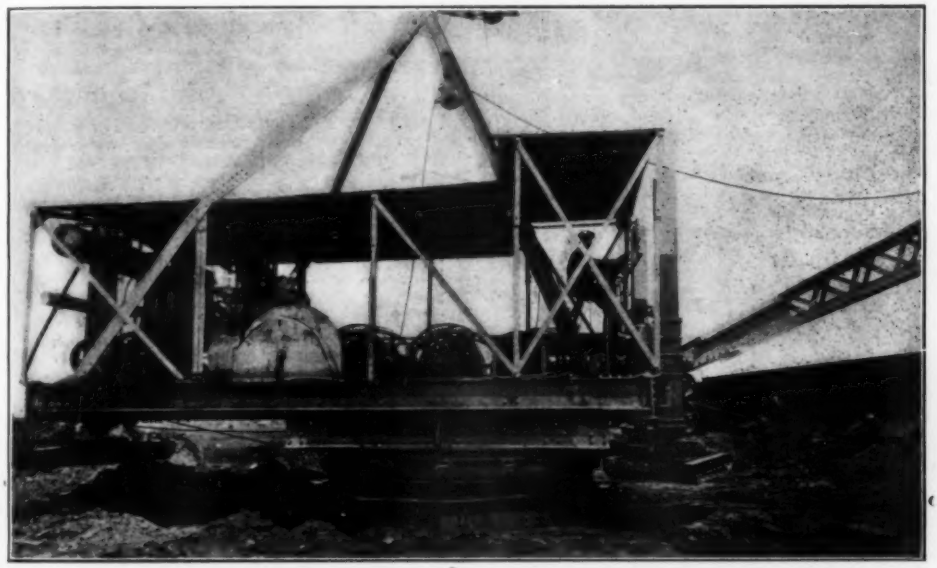
The Big Annual Event for Contractors

The Annual Road Show at Chicago will be held in the Coliseum, January 6-9, 1925. We will see you there.

A Walking Device for Heavy Draglines and a New Dragline Bucket

Mobility of Heavy Machines Materially Increased and Dragline Bucket Efficiency Amplified

NUMEROUS moving devices for draglines have been developed and found successful for small machines. However, until the recent development of a walking device by J. W. Page of the Page Engineering Company, Chicago, Ill., nothing has been found that will work satisfactorily on draglines of 40 tons and over. This new device is adaptable to all sizes of draglines and will work equally well on the biggest canal excavator or a small sewer excavator. Mats, rails, wheels and trucks, and crawler traction devices, are all eliminated. The addition of a sliding platform placed between the upper and the lower platform of the machine makes the moving device possible and facilitates travel over rough ground.

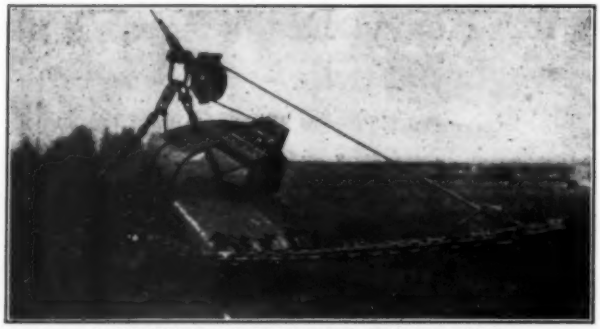


HEAVY-DUTY DRAGLINE WITH EQUIPMENT TO PERMIT WALKING OVER SOFT AND ROUGH GROUND

The usual lower platform is of octagonal shape and rests directly on the ground, giving a firm bearing surface for the operation of the dragline. The lower half of the rail circle is riveted to this platform. The upper half of the rail circle is riveted to the bottom of the sliding platform, whose center beams are contiguous with a set of rollers in the upper platform. Thus when walking, the lower and sliding platforms are as one, and when excavating, the upper and sliding platforms are as one.

The dragline is moved in any desired direction by four distinct but almost simultaneous operations controlled from the operator's stand and all accomplished in very quick time. Three spuds are placed upon the upper platform, one in the center of the machine at the rear, and one at each corner in the front. By the operation of the swinging frictions, the spuds are pushed down, elevating the whole machine; as soon as the lower platform is clear of the ground, it starts to slide back to the extreme end of the upper platform. When it has reached the proper position, the spuds are reversed and the machine lowered to the ground, when the upper platform slides back to working position, where it is ready for another step or for immediate operation. A maximum lift of 3 feet can be had if it is necessary in moving over very uneven ground or in getting out of a hole. The spuds are carried on the upper platform and swing with it so that a step can be taken in any direction—front, back, or to either side. An automatic locking device keeps the upper platform from sliding when in working position.

In designing the machine the idea of flexibility and mobility was continually kept in mind. For instance, the 1½-cubic-yard model, which has a 55-foot boom, can be put on a single flat car for shipment. In order to do so, the size was kept within the limits required by the railroads as to width, length and height. To keep within the required limit, the "A" frame is hinged just above the house roof so that it can be lowered for shipping. In shipping long distances through tunnels, the lower platform can be removed and divided



A DRAGLINE BUCKET WITH HINGED DOOR

into two sections, making it very easy to handle and to assemble.

A 4-cylinder, solid injection type diesel engine is used for power. This engine will use any low grade of fuel oil that will flow freely. It is one of the least complicated of the many full diesel engines made, eliminating air ejection, hot bulbs, hot plates, electric ignition and carburetors. The cost of operation is said to be less than one-fourth of that of the same size gasoline engine. The lubricating oil consumption does not exceed one gallon per 1,000- to 1,200-h.p. hours. The engine is direct-geared to the drum set by a pinion on the end of the driving-shaft. Starting from stone cold is accomplished without difficulty and almost instantaneously by means of compressed air. It is designed so that all working parts are easily accessible for inspection and dismantling. The engine develops 70 b.h.p., has 3 cylinders, operates at 350 r.p.m., and has a 8¼-inch bore and an 11-inch stroke.

A New Dragline Bucket

The new dragline bucket which has been developed by the Page Engineering Company is claimed to be especially efficient and desirable in excavating loose sand or wet material. As the door or end-gate of the bucket is hung forward of the cutting edge and closes on the outside of the bucket and not on the inside, the capacity of the bucket is increased as much as 22 per cent water-level measure. There are no side plates or other straps on the sides of the bucket.

The Page end-gate is hung forward of the cutting lip of the bucket by two bolts which go through the main and hood plates. The point of attachment of the pulling bail is at the forward end of the gate, so that the first pull of the drag-line opens the gate and tips the bucket to its initial digging position. The usual dump line also serves as a closing line for the gate. This dump line is attached at one end of the drag cable and on the other end to an arm on the back of the gate after passing over a sheave attached to the hoist bail and also over another sheave at the top of the hood. By retaining some tension on the drag cable when the bucket starts to hoist, a powerful closing action, similar to that on a clam-shell bucket, is imparted to the door, so that it has to close.

A dump cable direct connected from the end-gate to the hoist bail pulls the door wide open when the excavated material is to be dumped. In loading, the pull is in direct line with the usual point of attachment of the pulling bail, so there is no twisting strain on the end-gate. All operations are automatic. No moving parts come in contact with the material which is being excavated.

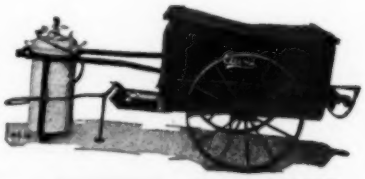
While the actual capacity of the bucket is increased only 22 per cent, the capacity of the dragline which is using this new type bucket is said to be increased approximately 30 per cent because a shorter pull on the cable is required to load it.

The bucket can be hoisted as soon as it has passed the point of the boom. The clam-shell action of the door picks up all the material in front of the bucket, making a clean job. The bucket can be used as a standard bucket with the door removed.

A Smokeless Asphalt Kettle

Oil-Burning Outfit Has Many Advantages in Contracting Work

A SMOKELESS tar, pitch and asphalt kettle for roofing, waterproofing, insulating, flooring and paving work, which it is claimed melts and heats twice as fast as a wood-burning kettle, has been developed by the Aeroil Burner Company, Inc., Hudson Avenue and Main Street, Union Hill, N. J. This kettle has two compartments; a dividing screen separates the cold material from the hot molten material and also prevents clogging of the draw-off cock. The burner will produce molten material within ten minutes after lighting the oil burner. Because of this method of heating, there is no waiting to kindle a fire, the fuel cost is remarkably low, and it is possible to accurately control the temperature. This prevents coking, eliminates ashes, smoke and sparks, and makes it possible to take the outfit indoors or on a roof instead of hoisting molten material to the job.



A SMOKELESS ASPHALT KETTLE MOUNTED ON WHEELS

The kettle is very compact and when not in use the inside kettle can be lifted out and the burner stored inside, thus saving considerable

space in moving from job to job. The kettle is of durable construction, having all the seams welded.

It is claimed that this kettle melts pitch at an average fuel cost of 50 cents per ton, or high melting point asphalt at $1 a ton, and in much less time than a wood fire. The burner which is supplied with this kettle can also be used for melting ice and snow on roofs, drying out concrete for waterproofing, drying out wet roofs, and similar heating and thawing purposes. The kettle is made in 50-, 75- and 100-gallon sizes and is constructed either with legs or mounted on wheels, as desired.

A Newly Developed Truck Crane

An Outfit Which Combines the Advantages of a Crane with the Speed of a Motor Truck

A FULL-REVOLVING truck-crane which can lift heavy loads at long distances has been placed on the market by Orton & Steinbrenner, 608 South Dearborn Street, Chicago, Ill. The crane can be mounted on any new or second-hand truck of 5 tons capacity having a distance of 8 feet between the back of the driver's seat and the center of the rear axle. A distance of 8 feet, 6 inches is preferred, as it produces a more evenly balanced machine. Almost all late models of 5-ton trucks have the 8-foot 6-inch distance, and 90 per cent of the old models are made with this dimension, so that practically no remodeling or rebuilding of the truck is necessary.

A feature which is exclusive in this O & S truck-crane is the removable counterweight compartment. As the laws of some states do not permit loads in excess of 10 tons to travel over hard-surfaced roads, the ballast which is necessary to maintain the balance may be dropped out by simply opening the bottom of the compartment. Sand is generally used for ballast and, of course, is readily obtainable anywhere at practically no cost.

TRUCK-MOUNTED CRANE HANDLING SAND FROM STORAGE

The design of the crane is such that all parts are readily accessible and may be removed or replaced with a minimum loss of time. The operating levers are banked on one side in front, so that the operator has a complete and unobstructed view of the work at all times. The general arrangement of the drums, gears and shafts is similar to that used on O & S locomotive cranes for the past twenty years, and the construction of the truck crane is practically identical with the larger types of cranes. All wearing surfaces and bearings are bushed with removable bronze bushings. The drums and sheaves are of large diameter and consequently easy on the cable. The frictions for operating the hoisting drums and for swinging are bronze cones with outside band brakes. The main train of spur gears and all other gears are cut steel. The shafting is forged and turned. Practically the entire crane structure is either cast or structural steel. All parts are manufactured on the duplicate part system, which insures a perfect fit. Greasing and lubricating is provided for by the Alemite pressure system, which distributes grease to every bearing.

The turntable is a heavy steel casting revolving on four large steel rollers. The "A"-frame supporting the boom is structural steel amply riveted and braced. Power is furnished by a heavy-duty Hercules motor, giving 37 h.p. Double drums are furnished on the main drum-shaft, and power is supplied to both so that in bucket-handling the bucket may be hoisted while open as well as closed.

This truck-crane will handle any material, such as sand, gravel, crushed stone, and slag when equipped with a ½- or ¾-yard clam-shell bucket. The truck crane can be run alongside a car and unload it in an hour or less. It loads trucks or wagons, stocks material into bins or hoppers, drives piling, handles lumber and sewer pipe, excavates for building foundation, sewer or water pipe trenches. With a generating set it can operate a 36-inch electro magnet and handle scrap iron, pig iron or castings around a foundry. With a hook and sling it will handle logs or erect structural steel buildings. It can go anywhere that a motor truck can go.

A Light-Weight One-Lever Shovel-Crane

A New Fordson-operated Machine That Digs Loads and Hoists

A ONE-LEVER shovel-crane, designed for attachment to the Fordson tractor to replace hand digging and loading, has been developed by the Anthony Company, Inc., Streator, Ill. This shovel may be readily converted into a portable crane. It is not designed as a competitor of the heavy steam or gasoline shovel, but supplements this larger equipment on construction work of any size. The structure or steel work supporting the shovel consists of five major welded sections, supported at three points on the tractor frame; thus all of the stresses it is possible to impose by push or pull or impact of the Fordson tractor are transmitted directly by the superstructure to the two points on the rear axle of the tractor, adjacent to each rear wheel.

DUMPING THE LOAD

The winch mechanism, with the exception of the spur gears and several small parts, is made up entirely from Ford and Fordson parts, replaceable practically everywhere. The shovel dolly consists of a rigid structure upon which are mounted four cast steel wheels that roll within the channel track of the boom portion of the structure. The shovel dolly is raised and lowered by a cable fastened by a yoke end to a swivel joint on the bottom axle of the dolly. The cable passes up to a sheave at the top of the boom, and down to the winch.

The shovel is rigidly fastened to the dolly by six ½-inch machine bolts. The movement of the shovel is therefore that of the dolly, and is determined by the direction of the boom channel track. To retain material gathered by the shovel in its lower position, the downward inclination of the bottom of the shovel changes to a slight inclination upwards as it is raised through the first few inches of its travel above the ground. At its uppermost position the shovel bottom is 79 inches from the ground, thereby clearing practically any motor dump-truck. The shovel has a capacity of ¼-cubic yard, but may easily handle ⅓-cubic yard when digging in soft dirt or any material that will heap. Discharge of the shovel is accomplished by a further application of power from the winch. This causes the dolly to pass around the curved track at the top of the boom. The shovel is therefore raised by power to an angle of 60 degrees, at which inclination the automatic throw-out arrests the motion of the shovel. Freeing the clutch on the winch allows the return of the shovel around the track, this being aided by a special return mechanism.

This machine may readily be converted to a 1,000-pound capacity portable or traveling crane, by substituting a hook for the shovel and dolly. The ⅜-inch cable has a safe working load of 2,700 pounds.

Operation

The shovel or crane is operated entirely by one lever. The shovel can be maneuvered into any position, with the tractor either in motion or at rest. When the shovel has been crowded into a bank or into the earth for excavation, and thus heaped full of material, a complete pull-back of the lever raises it to a position where it will clear the ground, and as the tractor is maneuvered close to a motor truck, or whatever it is desired to unload into, the shovel is further raised to a position that will clear the truck. The lever is then pushed clear forward, which throws out the clutch and applies the brake and holds the loaded shovel in position. Thus the tractor can be maneuvered to a point where the loaded shovel extends over the motor truck dump body. A complete pull-back on the lever again puts the shovel in motion, raises it, causing the dolly to roll around the curved track and dump the shovel. When an angle of 60 degrees is reached, the automatic throw-out pulls the lever out of the driver's hand. Holding on to the lever causes the shovel to flap and throws out all tenacious material.

This equipment may be used for cutting earth to grade in road making, for excavating, stripping over-burden, backfilling, cleaning the floor after a large steam shovel, and for loading all loose materials, such as gravel, sand, rock, cinders, coal, earth, snow, street refuse, etc. Equipped as a portable crane, it can be used for loading solids, lifting boulders from excavations and ditches, lowering pipe into trenches, and other contracting jobs where a light-weight crane is serviceable.

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS GUIDE, 1924-25

Published by the American Society of Heating and Ventilating Engineers, New York City, 1924. 458 pp., including condensed catalogs. $3.00.

In an endeavor to render a greater service to the science of heating and ventilating, the American Society of Heating and Ventilating Engineers has published its third annual edition of The Guide. This book contains reference and design data useful in the planning and construction of modern heating and ventilating installations, prepared from the Society's Transactions, from the investigations of its Research Laboratory and from the practice of its members. Included in this volume are catalog and reference data furnished by various manufacturers. The various chapters cover heat losses from buildings, heating by radiation, pipe sizes for steam heating, pipe sizes for steam with counter flow of condensate, the boiler, code for testing low-pressure steam heating boilers, pumps for heating and ventilating equipment, hot-water heating, warm-air furnace heating, oil fuel for industrial and domestic heating, gas heating, automatic control, insulation, pipe, pipe sizes for water-supply, ventilation, etc.

Solving a Road Construction Contractor's Biggest Problem

The Use of Tractors Eliminates the Need for Subbing Excavation and Grading

THE biggest of the many problems which must be faced by the road contractor in the building of large sections of hard-surfaced roads has recently been solved by the R. F. Conway Construction Company of Chicago, Ill. For many years this well-known road construction organization has, like most other contractors, depended upon subcontractors using teams and miscellaneous equipment for preparing the grade and moving dirt in all of the various operations connected with road building. Even though these subcontractors were most conscientious operators, it has been almost impossible to keep everything moving at a uniform rate to insure that all of the equipment in use rendered the most effective and efficient service. If the grading and other preparatory work does not proceed uniformly, paving operations naturally suffer costly and trying delays.

HOLT TRACTOR HAULING TRAIN OF WHEELED SCRAPERS OWNED BY R. F. CONWAY

On a recent contract calling for the construction of a 53-mile hard road in Illinois, the R. F. Conway Company solved their problem by motorizing the job with nine 10-ton Holt Caterpillar tractors. In connection with these they bought a large fleet of self-loading wheel scrapers and blade graders. All of the dirt-moving and grading operations on this job were handled by the tractors. Each tractor was run by an especially selected operator and the entire personnel was chosen with a view to getting the best possible service out of the machinery employed. Contractors have never figured any way to profit financially from "trimming" and "shouldering." On this job, however, the Conway Company found that the tractors performed these operations at approximately half the ordinary cost, thus resulting in a profit. One tractor pulls four scrapers at one time and one man handles the loading. These scrapers have a capacity of 1¼ yards.

Another highly important feature in this job is that fewer men are employed, in fact, less than half the usual number is customarily used on a job of this size. Under ordinary circumstances the average number of men and horses employed would be 63 men and 23 horses. Three Caterpillars and 10 men comprise each of the three camp outfits, making a total of 9 Caterpillars and 30 men working on the job. The three camps all work under the direction of one superintendent.

The Conway Company reports a general speeding up all along the line of operation, with dirt movers, pavers and graders moving from point to point in an orderly and uniform manner. The savings in time, temper, money, and general wear and tear on the dispositions of the men are items too important to be ignored by anybody interested in the highly exacting and precise business of building the nation's roads. In every phase of road construction, machinery is playing a more and more important part, but in no phase has machinery become so essential as in moving dirt in preparation for hard-surfaced roads.

Steel-Bottom Dump-Wagons

Many Features Give Strength and Durability

A STRONG, simple, well-built dump-wagon with steel bottom and solid steel axles, having a capacity of 1½ to 2 cubic yards of material, is manufactured by the Acme Wagon Company, Emigsville, Pa. The steel doors of this wagon are suspended with three rigid hook hinges passing through an opening in the bottom and around heavy tubing on the edge of the door. This tubing forms a strengthening bar for the back edge of the door and a large bearing for the door to swing on. The doors overlap each other, making the wagon sand-tight.

Four bolts over the wheel-house bolting drawbar run to the front bolster, preventing the strap bolt from breaking off at the bolster. There is a steel plate lining on the outside of the body over the wheel-house, strengthening this spot, which is usually weak in dump-wagons, and making it practically unbreakable. There are no chains on the inside of the wagon; thus it dumps clean, quickly and clear.

The wheels, which run on solid steel axles, have either 3- or 4-inch tires, and the wagon is equipped either with or without a spring seat and brake.

A Folding Steel Bin

Outfit Equipped with Batch-Measuring Devices for Concrete Road Work

A PORTABLE steel bin with batch-measuring devices attached has been developed by the Butler Equipment Company, Waukesha, Wis. This bin can be easily moved from one job to another because of the folding features.

The sides of the bin and the center partition are fastened together by heavy hinges, so that these parts may be folded down when moving, thus reducing the height of the bin to 11 feet. Instead of using bolts to fasten the folding parts together, slotted keys and tapered wedges are used. The measuring devices remain in place when moving. Because of these features it is possible to set this outfit up ready for work with a crane and two men in about one hour. It can be dismantled ready for moving in about the same time. The bin can be moved and set up to straddle a truck, making it available for use with industrial railway equipment as well as with trucks. Both the bin and the measuring devices are built of 3/16-inch steel plate and are constructed to stand rough usage. The bin is made in two sizes, of 40 and 60 tons capacity.

THE BUTLER BIN, KNOCKED DOWN FOR HAULING AND SET UP FOR SERVICE

A New Transparent Dampproofing for Concrete, Brick and Masonry

New Material Does Not Darken or Discolor Surface When Applied Like Paint

A NEW transparent dampproofing, intended as a surface application over concrete, stucco, brick and masonry, has recently been placed on the market by the Truscon Laboratories, Detroit, Mich., under the name "Super Por-Seal." Transparent dampproofings are not new on the market, but the Truscon Laboratories claim that this new material represents a departure from the general line of transparent dampproofings. Most materials in this class in the past, it is stated, have been made of waxes, petroleum or other mineral oil bases. The result has been a slight tendency to stain the surface, due to the oily nature of the compounds. The Truscon Laboratories also had a material along these lines, which had been marketed for many years.

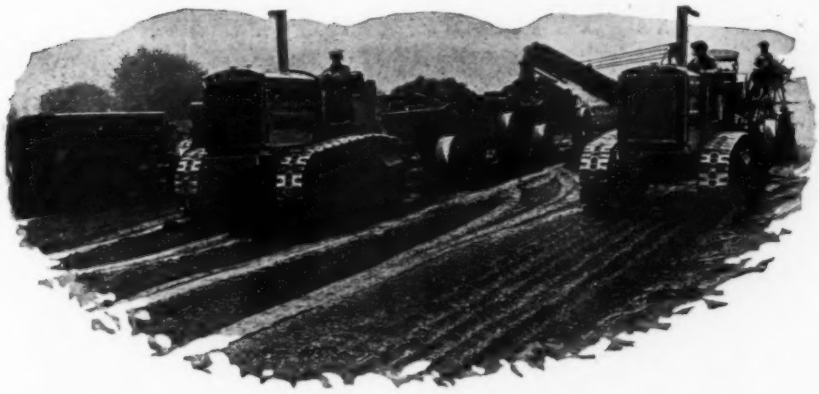
This new dampproofing falls in with the idea which has been established by the Truscon Laboratories in the use of water-repellent compounds for this type of work. Its general composition is much the same as this company's integral waterproofing for concrete, except that it is in a clear solution. It is absorbed into the pores of the stucco or masonry, where on evaporation of its volatile solvent it lines these pores with a highly water-repellent compound. Some interesting tests have been made of stucco surfaces treated with only one coat of this material, and stuccos without any dampproofing. A bucket of water thrown on the untreated stucco surface immediately darkens the wall, indicating water absorption. Water thrown on the treated surface shows no darkening, as it runs right off. Such a material naturally is a great protective coating against moisture and frost for stucco, concrete, brick and stone, materially lengthening the life of the protected material, as it saves it from weathering and moisture.

Stresses in Girder Hooks

IN the case of mild-steel hooks having a rectangular cross-section, such as are often used for lifting heavy girders, it is not possible to tell by visual inspection whether any parts of the hooks have been stressed beyond the proportional or safe limit of the material. This is one of the important conclusions drawn by the Bureau of Standards of the Department of Commerce as a result of thorough tests carried out on nine hooks.

At the critical section—in other words the section of the hook at which failure is most likely to occur—the actual stresses under a given load were higher, with one exception, than those given by the usual formulas. Certain special and more complicated formulas, however, have given results which are correct. Since the observed stresses and the results as given by these more complex formulas are in no case more than 20 per cent greater than the stresses as computed by the ordinary formulas, it is believed that if a sufficient factor of safety is employed, the usual formula will be safe to use for most work. At points other than the critical section, the ordinary formula gave values which agreed closely with the actual stresses observed in the tests.

The nine hooks employed in this work were supplied by the American Bridge Company, and loads of 5, 10 and 15 tons were used in the tests. The actual stresses were measured by a strain gage which indicated the stretching of the material under load. The load required to stretch the metal a given amount was first determined by testing small samples cut from the hooks in an ordinary testing machine. A complete description of the investigation, with the conclusions drawn, will be found in Technologic Paper No. 260 of the Bureau of Standards, copies of which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents apiece.



The Most Efficient Power Known

HOLT TRACK LINK

The track shoe and rails are an integral casting of specified analysis, high carbon cast steel. They are subjected to heat treatments in the Holt plant under the control of experienced workmen, to refine the structure of the metal and to increase the tensile strength and hardness value. The track links are subjected to t w o h e a t treatments. Upon completion of the last operation the physical values are as follows: Tensile strength (as cast), 50,000 lbs.; (after Holt Heat Treatment), 150,000 lbs. Sclerescope hardness (as cast), 30 lbs.; (after Holt Heat Treatment), 40 to 50 lbs. Superior material and the longest life tracks are obtained from the use of correct steel castings, c o r r e c t l y heat treated. Holt Heat Treatment triples the original strength and increases the hardness about one and one-half times.

At Wanaque, the New Jersey Water Commission is converting 2300 acres of timberland and meadow into a reservoir to provide a 28 billion gallon water supply for the manufacturing districts surrounding Newark.

On this engineering project, involving the moving of over 2 million yards of earth and the construction of 6 huge dams, only the most dependable machinery could be safely employed by the contractors, Clifford F. MacEvoy Company.

After long investigation a fleet of "Caterpillar" tractors were selected for important phases of land clearing and earth moving work; and following months of constant service, Mr. MacEvoy says: *"The 'Caterpillar' is unquestionably the most efficient and economical power I have ever known."*

Every engineer, contractor and road official should investigate "Caterpillars" in the field; and their records of economy and long service. Write us for the facts.

The 2-ton handles all the lighter jobs. The 5-ton pulls a blade, a subgrader, light scarifier or other tools. The 10-ton handles the largest grader and puts up the biggest daily yardages; it has maximum power for every tractive job.

Send for our illustrated booklet.

The Nation's Road Maker

There is but one "Caterpillar"—Holt builds it.

THE HOLT MANUFACTURING CO., Inc.

PEORIA, ILLINOIS **STOCKTON, CALIF.** [redacted]

***Eastern Division:* 250 W. 54th Street, New York**

CATERPILLAR
Reg. U.S. Pat. Off.

High-Pressure Road Pumps

Equipment Capable of Supplying 60 Gallons per Minute Against Pressures Up to 500 Pounds

A PARTICULARLY useful high-pressure road pump unit, consisting of a 3 x 5-inch triplex pump, direct-connected to a 4-cylinder Hercules heavy-duty gasoline engine, capable of delivering 60 gallons per minute at 500 pounds where necessary, has been placed on the market by the Aldrich Pump Company, Allentown, Pa. The 4-cylinder Hercules engine has a rated horsepower of 30 to 45 pounds and is fully equipped with throttling governor, high-tension magneto, float feed carburetor, clutch, radiator cooling equipment, and gasoline tank.

The triplex pump embodies the three-throw crank-shaft principle, with cranks set 120 degrees apart, so that the strokes follow and overlap one another, producing a constant, even, flowing stream, eliminating water-hammer in the pipes; all of which makes for a smooth operation and reduces friction in the lines. The pumps are single-acting, giving positive displacement with a minimum slippage and low losses. They are outside packed, permitting adjustments and lubrication while the pump is in action. Any leakage is immediately noticed.

The pump and engine are housed separately, each being totally enclosed and equipped with the necessary doors and padlocks. The entire unit is mounted on extra-heavy steel channels and steel wheels and axles. The regular fittings include by-pass, check valves, large relief valves, pressure gage, a totally enclosing gear guard, grease cups, tools and wrenches.

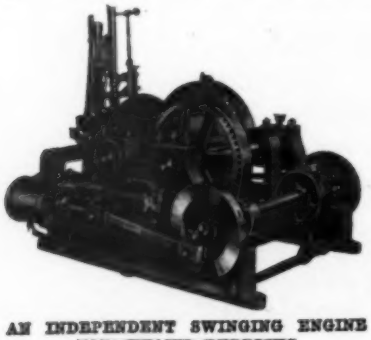
AN EFFECTIVE PUMPING UNIT

The No. 6, the pump of which has a diameter of 3 inches and a stroke of 5 inches, is capable of handling 60 gallons per minute or 3,000 gallons per hour. The engine produces 30 h.p. at 1,000 revolutions per minute. The suction and discharge openings of the pump are 3 inches in diameter. The entire outfit measures 96 inches long, 66 inches high; and 58 inches wide. The gross weight is 4,200 pounds. The pump is capable of lifting to a maximum height of 1,155 feet, or a pressure of 500 pounds.

A New Hoisting Engine

Compact Construction Featured in This Unit

A RECENT development in the line of hoisting engines of the Clyde Iron Works, Duluth, Minn., is a compound-geared, double-cylinder, independent-swinging engine especially adapted for heavy barge derricks or dredges. The compact construction of this swinger makes it an attractive unit where space is limited. Placing the winding drum inboard at the rear of the hoist reduces side strain to the bed and at the same time makes a long lead of the swinging cable possible even where the space between the swinger and the bull-wheel is so limited that the guide-sheaves have to be placed close to the swinger. The machine is equipped with machine-cut gears and extra heavy shafting to withstand the severe strains encountered in dredge work. A band brake operated by a latched hand lever and gripping the crank-shaft will hold the boom against rotation in any direction. The swinging motion is controlled by a reversing throttle valve. The cylinder valves are of the easy-working piston type. Most parts of this engine are interchangeable with the 4¾ x 6 Clyde steam hoisting engine.

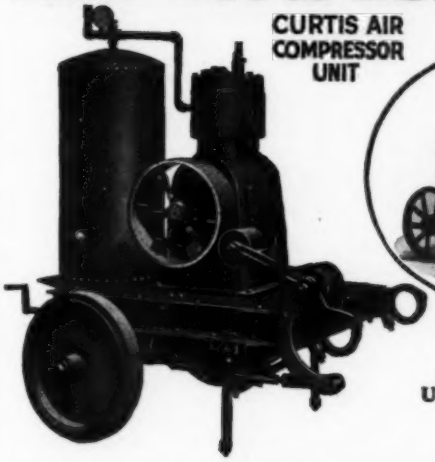


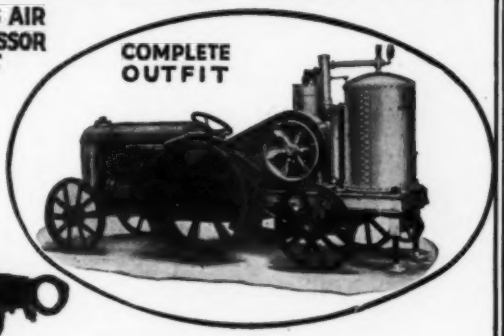
AN INDEPENDENT SWINGING ENGINE FOR HEAVY DERRICKS

Levison Heads Blaw-Knox Road-Building Engineering Department

THE Blaw-Knox Company, Pittsburgh, Pa., has announced the appointment of Arthur Levison, Highway Engineer, U. S. Bureau of Public Roads, as chief engineer of the road building department of the company. Mr. Levison has been successively Inspector of Road Construction of the New York State Highway Department; Assistant Engineer of Barge Canal Construction, New York State; Assistant Engineer, Subway Construction in New York City; Engineer in Charge of Reinforced Concrete Building Construction at the Washington Navy Yard; and since 1919 has been connected with the U. S. Bureau of Public Roads.

CURTIS-FORDSON AIR COMPRESSOR OUTFIT





Sold as Complete Outfit or Unit Can be Bought Separately

Fills A Much Needed Want

Here is just the thing contractors are waiting for—a portable air compressor unit that operates with any Fordson Tractor, making a complete self-contained outfit. Can be used on a hundred different kinds of jobs where a supply of compressed air is temporarily needed. An outfit that can be moved from job to job quickly by its own automotive power—no extra truck for pulling necessary.

50% More Service

The average contractor can easily get 50% more service out of the Curtis Fordson Compressor Outfit than from the ordinary portable compressor outfit, which is heavy, cumbersome, expensive and serves only a single purpose. It must be remembered that the Curtis Fordson has every quality of the ordinary portable compressor outfit plus the advantages of detaching the Fordson Tractor and using it for all tractor purposes.

Wide Range of Uses

The flexibility of the Curtis Fordson Air Compressor Outfit is remarkable—ideal for the road contractor, structural steel field jobs, oil field work, telephone construction, well drilling, etc. Just the thing to supply air for jack hammer drills, paving breakers, riveting hammers, rammers and tampers, compressed air hoists, sand blasts, stone cutting tools, quarry tools, rivet forgers, clay and coal mining diggers, for pumping water, for washing autos and trucks, unloading tank cars, paint spraying, caulking pipe lines, etc. For city streets can be equipped with rubber tires.

Tractor Used Independently

When the Curtis Fordson is not being used as a compressed air outfit, the Fordson Tractor can be detached and used independently for hauling, loading, moving or power-driving purposes. The coupling is simple—nothing to get out of order or misfit. The whole arrangement is sturdy and practical—the Air Compressor Unit can be attached or detached by anyone in a few moments.

If You Now Have a Fordson

The Curtis Air Compressor Unit can be purchased separately. Used in connection with a Fordson, it opens new fields of work for the tractor and an additional source of revenue for you. You know the reliability of the Fordson—and you know the reputation and dependability of Curtis Air Compressors. The Curtis Unit is backed by 70 years' manufacturing experience, 27 of which have been devoted to the manufacture of pneumatic machinery, and our $1,500,000.00 institution. So you take no chances whatever.

Reasonable in Cost

The Curtis Fordson Air Compressor Outfit can be purchased complete, tractor and all, from us, or the Curtis Compressor Unit can be had separately. Mail coupon for full particulars and prices.

Curtis Pneumatic Machinery Co.
1671 Kienlen Ave. St. Louis, Mo.

1671
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Gentlemen: Please send me full information, your proposition and prices on:
☐ Curtis Fordson Air Compressor Outfit Complete
☐ Curtis Air Compressor Unit Only
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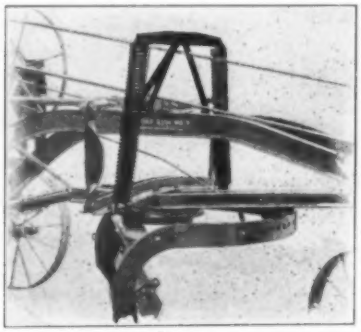
Address . . . . . .
. . . . . .

Equalizing Lift Springs Ease Grader Operation

Chattering and Jumping of the Blade on Maintenance Work Eliminated by New Attachment

EQUALIZING lift springs are now furnished on several of the graders made by J. D. Adams & Company, Indianapolis, Ind., which had hitherto not been furnished with this equipment. The construction and operation of the springs illustrated are very simple. They are placed directly over the blade assembly, in line with the lifting, so that their prompt and free action is not hindered in any way. The springs are suspended from a rocker arm which equalizes the tension in the two springs. They are of such tension that the blade assembly is suspended in a balance when the blade is about two inches from the ground. Because of the equalizing action through the rocker arm, most blade adjustments can be made with the hand wheels fairly spinning in either direction. For instance, in lowering the point of the blade for making a plowing cut, there is a downward pull on the right-hand spring which causes an upward pull on the left-hand spring, helping to raise the heel. In lowering the heel and raising the point of the blade, the adjustment is made with the same easy, rolling action.



A SPRING LIFT THAT MAKES GRADER OPERATION EASIER AND BETTER

In lowering the entire blade to cut in surface maintenance work, enough tension is put on the springs to create a considerable upward pull. As any play develops in the various working joints of the blade control due to wear, this upward pull takes up any such play, holds the working joints in close contact, prevents lost motion, and thus eliminates that chattering or jumping action of the blade which tends to produce a choppy or corrugated surface. With the blade held in this rigid position, it cuts with a steadiness and smoothness not approached by graders not having this feature, thus improving the work.

Steel Scaffold Brackets with Special Features

Safety an Essential in Brackets for Building Work

THE question of proper scaffolding is a serious one for any contractor. If his workmen are to give their best efforts, they must be safeguarded from accidents and furnished with good, sound footing. Scaffolding is only as safe as the brackets used. Quick-Set scaffold brackets, made by the J. L. Austin Manufacturing Company, Menomonee Falls, Wis., are claimed to have admirably stood the test of severe service in the field.

These brackets, when set up, are triangular, the top chord being made of two pieces of angle-iron, riveted together. This chord is 4 feet in length and pierced with safety perforations. At the inner-end of the top chord is a cast steel hook which fastens on the sheathing, giving a dependable, secure hold. A lock link chain which is fastened to the diagonal helps to tighten the steel hook. The vertical section of the bracket is made of two pieces of angle-iron, each 4 feet in length, perforated at the bottom to prevent side swing. An angle-iron is also placed at the top of the perpendicular to prevent side swing, giving a double safety check. The diagonal is a tee iron which gives rigidity and to which the chain is locked, holding the safety hook. The complete scaffold bracket when folded up weighs approximately 19 pounds and is compact and easy to handle.

STEEL SCAFFOLD BRACKETS IN USE

"JUST ANY SHOVEL"

Won't do for the Moulder. He insists on an

"O. AMES" SHOVEL

BECAUSE—

It has the Proper Balance and Holds its shape.
It has the Proper "Hang" and is just the right weight.
It is designed right and made right by skilled workmen of special steel and the best ash handles obtainable.
It is the cheapest considering the length of service it gives.

It isn't only the Moulder who appreciates a good tool and takes care of it but good workmen everywhere on any shovelling job recognize the superior qualities of

"O. AMES" BRAND

The Standard for 150 Years

SHOVELS—SPADES—SCOOPS

Distributed throughout the United States by the foremost dealers only.

AMES SHOVEL & TOOL COMPANY
BOSTON

1774 150 YEARS OF REAL SERVICE 1924

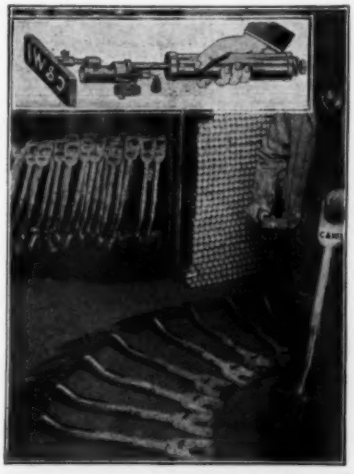
Branded Tools *"Wear Out"*
Unbranded Tools *"Disappear"*

YOU lose tools and equipment on nearly every job due to intentional theft or unintentional appropriation. Your tools get mixed up with others and the contractor with the easiest conscience comes out ahead.

Therefore

You have long felt the need of an inexpensive branding iron like the Everhot for quickly branding tools, sheeting, wheelbarrows and other equipment.

The torch of the Everhot branding tool keeps heating the brand all the time you use it, so it stays hot and brands continuously. It was designed especially for contractors' use in protecting their equipment.



Everhot equipments are priced as low as $14.00.

Write for descriptive circular.

EVERHOT
America's Brand Makers
MANUFACTURING CO.
Maywood, Ill.

Fordson and 2 Men Replace 2 Teams and 3 Men at Sand Pit

Fordson Moves 125 Tons of Sand and Gravel to Tipple as Compared to 75 Tons Formerly Moved in One Day

The cost of moving 75 tons of sand and gravel to the tipple with 2 teams and 3 men at the Imperial Sand and Gravel Screening Plant, Columbus, Ohio, was $18.75 or 25 cents per ton.

Now with the Fordson and two men, 125 tons of sand and gravel are moved to the tipple in one day at a total cost of $15 or 12 cents per ton. The net saving is $16.25 a day.

Saving in 61 Days Pays Cost

"By saving us over 13 cents on every ton of sand and gravel," says Mr. L. A. Bowker, Manager, "the Fordson and equipment pays for itself in 61 working days."

"On stripping clay, the Fordson, by actually replacing 2 teams, saves us over $9 a day and in addition does more than four times as much work as a team. A team, scraper, and 3 men strip 45 cubic yards a day at a total cost of $19. The Fordson, with 1 automatic scraper, and one man strip 200 cubic yards a day at a total cost of $9.85.

Big Money Saver for Anyone

"The Fordson has met successfully every test we have put it to in this work. We used it for stripping clay when frost was still in the ground. It demonstrated its ample power by plowing a 14-inch furrow in frozen red clay while going up a stiff grade.

"The Fordson is a big money saver for anyone in this business and is the power unit best adapted for the work."

Let your nearest Authorized Dealer demonstrate the saving in time, labor and money possible in your business through the use of Ford Trucks and Fordson Tractors.

Fordson Tractors, $495 f. o. b. Detroit

Ford

CARS · TRUCKS · TRACTORS

Send the Coupon!

Simply indicate the classes of equipment in which you are interested—with which you are anxious to accomplish the most work, in the shortest time, at the least cost.

The Ford Power Equipment Exposition—the largest and most important Exposition of its kind in the world—is at your service. It is dedicated to your service.

Its 150 exhibits, the products of eighty leading American manufacturers, point the way to accomplishing all manner of engineering, building or contracting work in the most efficient and economical manner.

This is because all the equipment on exhibition uses the Fordson Tractor or Ford one-ton Truck, everywhere considered as the world's standard power-units.

The Ford Power Equipment Exposition will gladly give you any information you may desire on any of the equipment listed below—gratuitously. Tear out the coupon below. Write in the items on which you wish information, sign your name and address and send to-day.

Hoists—Portable and Stationary	Trucks	Back Fillers
Air Compressors	Trailers	Scoops
Agricultural Implements	Concrete Mixers	Scrapers
Saws and Planers	Locomotives	Wheels
Excavating and Grading Equipment	Snow Plows	Crawlers
Material Loaders	Rollers	Shovels
Dump Bodies—Hydraulic and Gravity	Arc Welders	Saw Mills

Electrical and Service Shop Equipment

Ford

POWER EQUIPMENT EXPOSITION

Ford Motor Building **54th Street at Broadway, New York City**

Name .....

Address .....

I am interested in the following equipment:

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Patent Applied for

Cut Your Hauling Costs

Equip Your Ford Trucks with a

Stewart Quick Acting Self Dumper Steel Body

Save Time—Save Labor—Save Money.

THE STEWART IRON WORKS CO.
Incorporated
COVINGTON, KY. CINCINNATI, OHIO

Green Bottomless Power Drag Scraper

For excavating, digging and conveying with power instead of labor.

L. P. GREEN
1234 Monadnock Block, Chicago

The "High Sign"

THE WAUGH sign on a rock drill, drill sharpener, hoist, or compressor outfit is the contractor's and engineer's "high sign" everywhere. They know this "high sign" always implies high speed, high efficiency and completely satisfactory performance. Look for it.

The Denver Rock Drill Mfg. Co.
DENVER, COLORADO

ELEVATORS
CONVEYORS

HAISS
MATERIAL HANDLING EQUIPMENT

HOISTING EQUIPMENT

THE GEORGE HAISS MFG. CO.
143nd St. and Park Ave., New York, N. Y.
Established 1892. Representatives throughout the world.

Barrows for Every Job
Price and Delivery Right

Send For Particulars

Puffer-Hubbard Mfg. Co. Minneapolis, Minn.

SPEED plus ECONOMY plus PERFECT RESULTS

The BERG CONCRETE SURFACER

Speed:—When removing projections and fins only, in preparation for a float or rubbed finish, the BERG CONCRETE SURFACER will prepare 100 square feet per hour. The stone Grinding Attachment will produce from 35 to 50 feet of perfect surface per hour.

Economy:—The expense of operating the BERG machine represents a saving of from 50 to 75 per cent over any other process.

Results:—The BERG Cutting Tool produces a surface that forms a perfect bond for float or other finishes.

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State of New York, County of New York, ss:

Before me, a Commissioner of Deeds in and for the State and county aforesaid, personally appeared Edgar J. Buttenheim, who having been duly sworn according to law, deposes and says that he is the President of the Buttenheim-Dix Publishing Corp'n, Publishers of Contractors' and Engineers' Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

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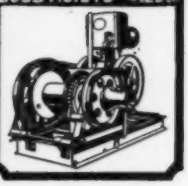

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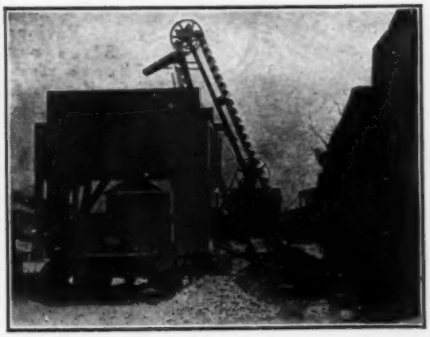

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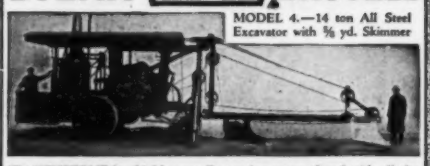

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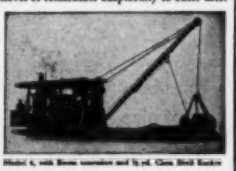

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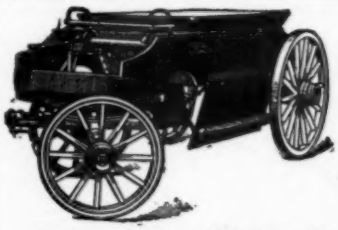

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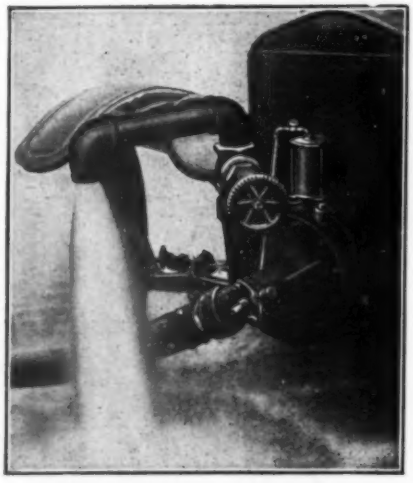

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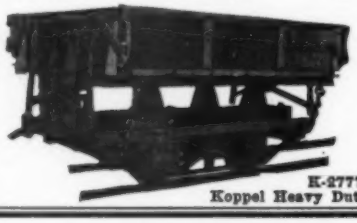

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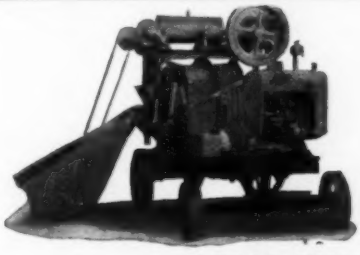

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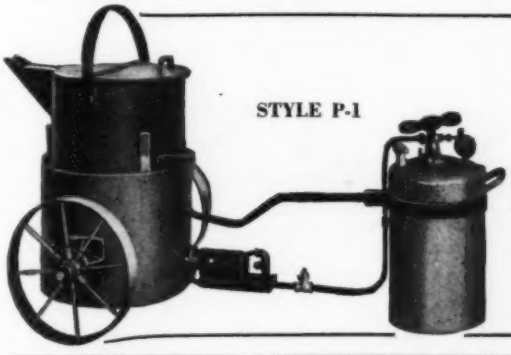

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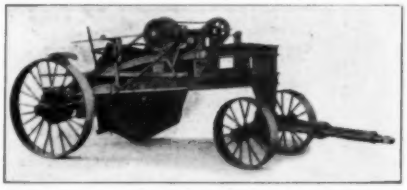

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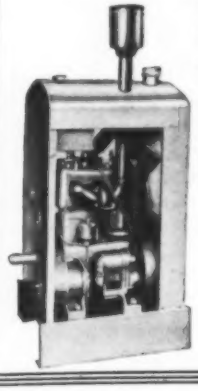

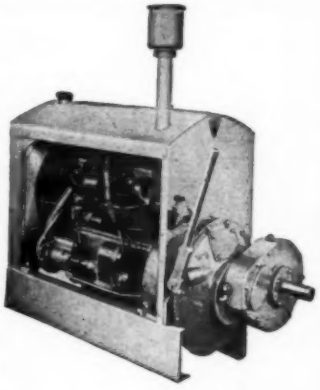

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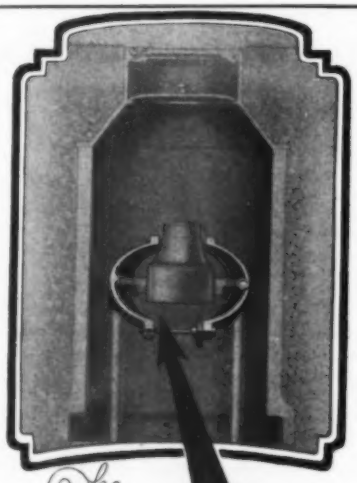

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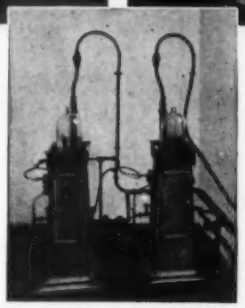

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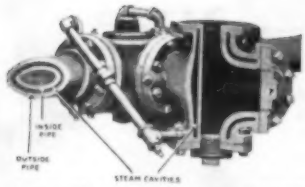

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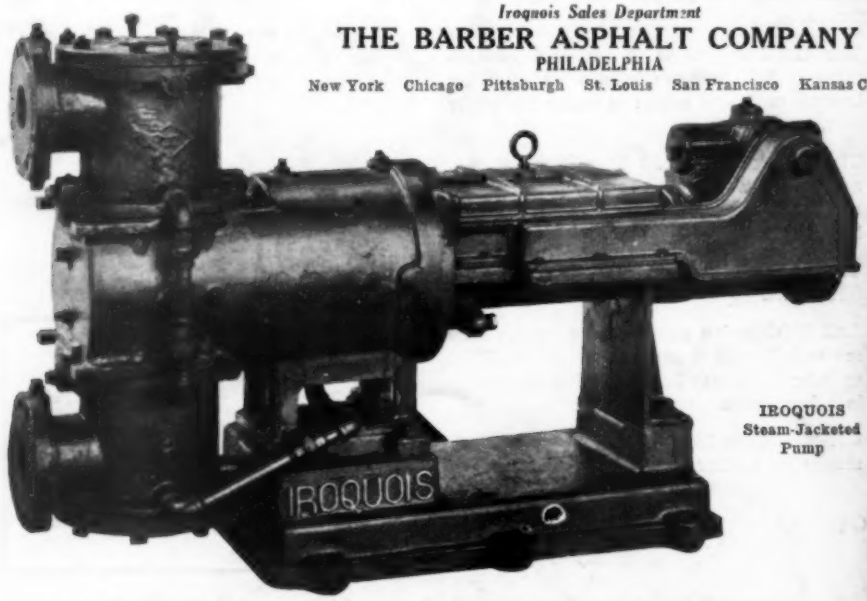

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